New Junior Encyclopedia

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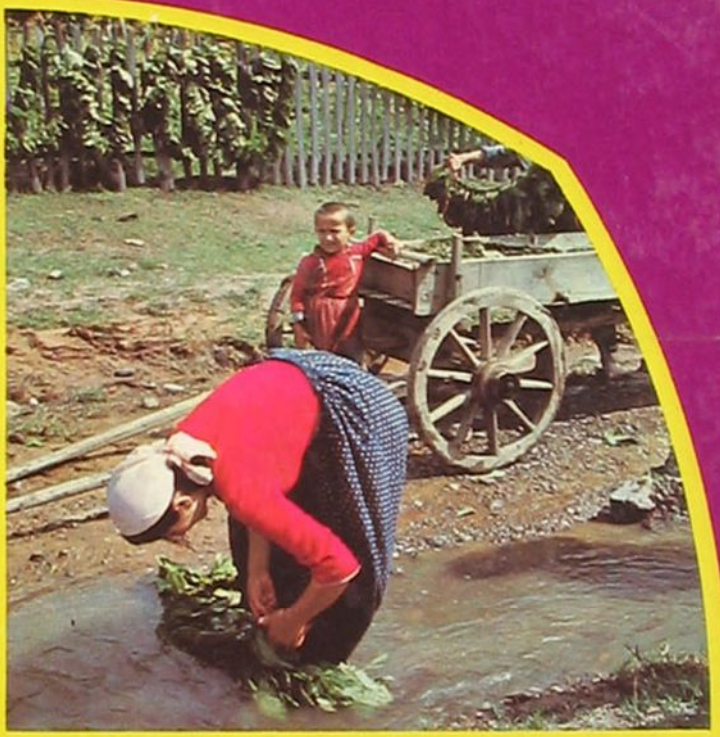

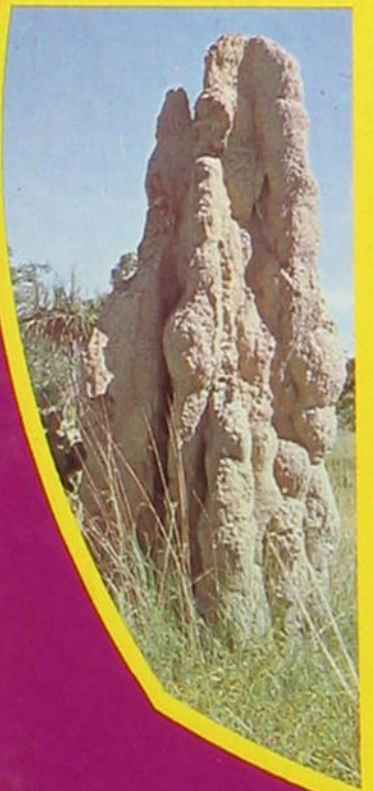

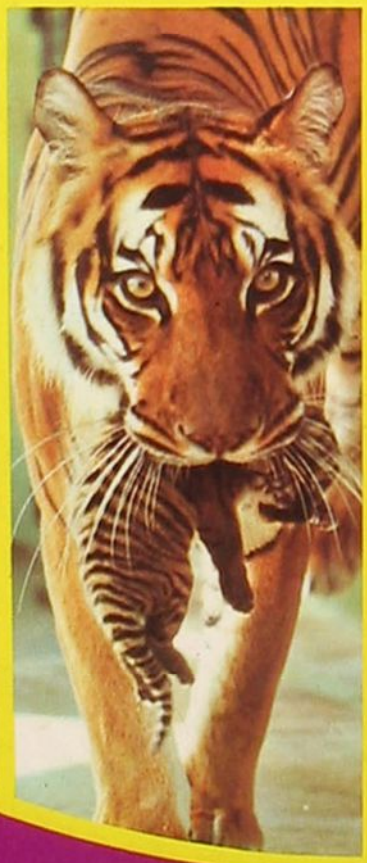

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A mute swan and three cygnets.

A location map of Surinam.

Surinam is an overseas territory of the Netherlands. It is also called Dutch Guiana. The territory is on the north-east coast of South America. Its area is 53,143 square miles. Its fertile coastal region is flat and swampy. Inland are mountains and forests. Paramaribo, the capital, is the biggest city. Surinam's population of 480,000 includes Negroes, Asians, American Indians and Europeans. The main industries are agriculture and mining; Surinam is a leading producer of bauxite.

Surrey (area 650 square miles), an inland county of south-eastern England, lies on the southern and south-western outskirts of London. Its county town is Guildford, but it is administered from Kingston on Thames. Its population is one million.

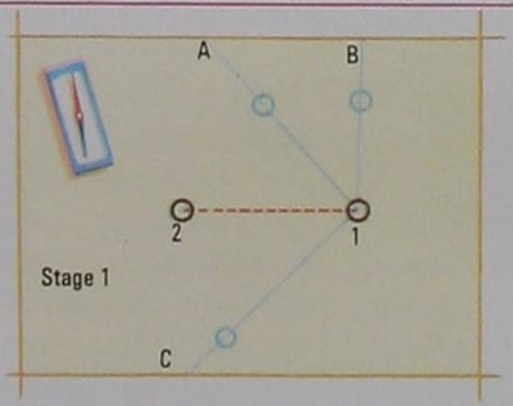
A chalk ridge of the North Downs crosses the county from east to west, its highest point being Leith Hill (965 feet). The Hog's Back, linking Farnham with Guildford, and Box Hill, outside Dorking, are well-known landmarks.

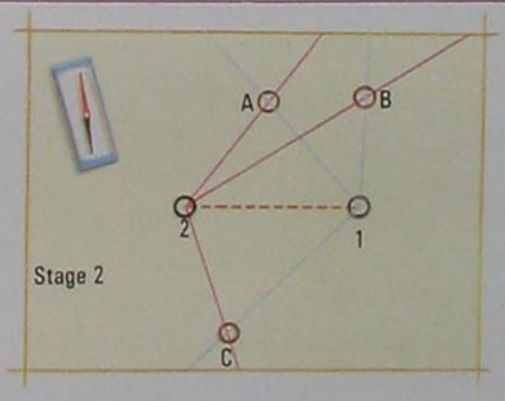
The north-east of the county is heavily built up into a huddle of small towns and villages, which serve as 'dormitories' for workers travelling into London each day. Apart from this residential area, much of Surrey is taken up with market gardening and dairy farming.

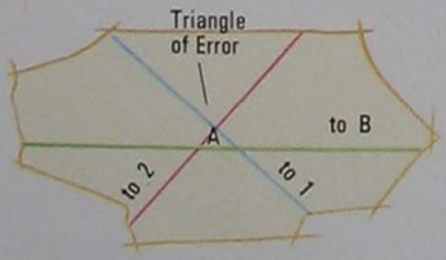
Surveying is a method of making exact measurements of the Earth's surface. Surveyors provide the information from which maps can be drawn.

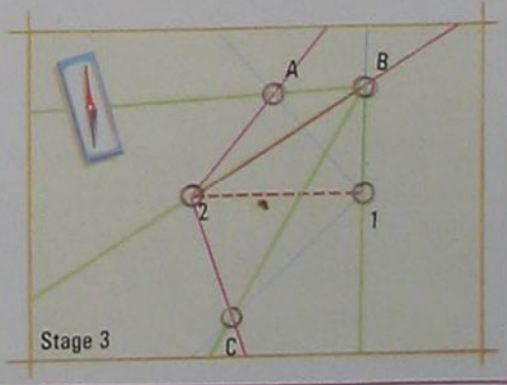
A surveyor's basic work is to measure or calculate the distances and angles between various points on the land. This is often done by a method called *triangulation*, which is based on the fact that once one side and the three angles of a triangle have been measured, then the length of the other sides can be calculated. Another method of increasing importance today is *trilateration*, which is based on the fact that we can work out

Stage 1: Bearings of points A, B and C are taken from point 1. Stage 2: Bearings of the same points are taken from point 2 at the other end of the base line. Stage 3: Bearings of points A, C and 2 are taken from point B. Below: Calculations give the positions of points A, B and C each within a triangle of error. Right: The bearings are measured with a theodolite.









The town of Rye in Sussex was a busy port in the Middle Ages. But now the sea has retreated, and houses that once looked over the harbour face flat marshland.

the angles of a triangle from the lengths of the three sides.

In triangulation, a surveyor starts with a *base line*. Base lines are usually measured between two concrete points fixed in the ground. To find the position of a third point in relation to the base line, the surveyor measures the length of the base line. He then measures the two angles formed between the base line and the point. The position of the third point can then be calculated. A triangulation survey of an area is made by fixing points over the land in a series of triangles. The heights of mountains and other features can be worked out from the measurement of vertical angles.

A surveyor uses a *theodolite* to measure angles between two points. It consists basically of a telescope with horizontal and vertical plates marked in degrees, set on a tripod. The theodolite is first levelled by means of a *spirit level*. The first point is sighted by cross-hairs in the eyepiece of the telescope, and then the telescope is moved to sight the second point. Readings on the horizontal plate give the angle through which the telescope has been moved, and therefore the angle between the two points. Readings on the vertical plate give measurements of vertical angles.

Since the 1950's, new methods have changed much of traditional surveying. For example, distances can be quickly measured by accurate instruments that record the time taken for electromagnetic or light waves to travel between two points. These instruments have greatly speeded up land surveying and made it possible to survey the land quickly by *trilateration*, in which distances, not angles, are measured. The detail of the land is now largely mapped from air photographs.

Sussex (area 1,460 square miles), a south-east coast county of England, was divided for administrative purposes into East Sussex (county town, Lewes), and West

Sussex (county town, Chichester). Its population is 1,241,000.

The county is crossed from north-west to south-east by a chalk ridge of the South Downs. This reaches the English channel in the steep cliffs at Beachy Head. North of this ridge is The Weald, a once heavily forested region now supporting orchards and crops. Sheep and cattle are reared on open grazing land.

Tourism is an important industry, and among the popular south coast resorts are Brighton, Hastings and Worthing. Newhaven is the main port for cross-Channel services. Many historic remains include earthworks at Cissbury, and castles at Pevensey, Lewes and Arundel.

Sutherland (2,030 square miles) is a bleak county in the extreme north-west of Scotland. Its county town is Dornoch, and its population, steadily decreasing for many years, is 13,000.

The county is mountainous, particularly in the west, where Ben More Assynt rises to 3,273 feet. Deep sea lochs cut into the rugged coastline, and wild moorland and deer forests cover much of the interior. Crofters make a poor living raising sheep and growing root crops on their small farms. In and around Dornoch some woollens are manufactured, and whisky is distilled.

Swans are beautiful water birds with long, slender necks. They belong to the duck family, of which they are the largest members. There are five white species, including the trumpeter and whistling swans of North America, the whooper swan, Bewick's swan, and the mute swan of Europe and Asia. The black-necked swan lives in South America and the black swan in Australia. Male birds are called cobs, hen birds are pens and the young are known as cygnets.

Swaziland is a landlocked kingdom in southern Africa, bounded by Mozambique in the east and South Africa on the other three sides. Its total area is 6,704 square miles, and its capital is Mbabane. Most of

A mute swan and three cygnets, or young swans. When they are young they have dull brownish feathers.

the 408,000 people are black Africans of the Swazi group. They grow maize and sorghum for their own needs, but

This map shows the location of Swaziland.

some export crops such as sugar-cane, cotton and citrus fruits are also grown, and cattle are reared.

The Swazi moved into the region when the Zulus expelled them from Zululand in 1820. The country gained independence in 1881, but became a protectorate of Britain following the Boer War. Swaziland became independent again in 1967.

Sweden is a northerly country in Europe that is part of the Scandinavian peninsula. It is bordered by Norway on the west and north, by Finland on the north-east, and by the Baltic Sea to the east and south. Denmark lies to the south-west, across a channel called the Kattegat.

The most northerly region of Sweden is part of Lapland, an area stretching across Norway, Sweden, and Finland into Russia. The northern part of Sweden, covering nearly half the country, is known as *Norrland*. The land there slopes down from the mountains on the Norwegian border to the Baltic Sea. It is thickly forested, with many streams and lakes.

The central part of Sweden is a lowland plain, containing several large lakes and some good farmland. To the south of this plain is a plateau of forests, swamps and moorland. Scania, in the south, is a fertile peninsula.

Summers in Sweden are mild, but the winters are very cold. The northern end of the Gulf of Bothnia is frozen over for half the year, and the important port of Luleå, from which iron ore is shipped, is out of action. The ore is then sent by land to the port of Narvik, in Norway. Stockholm, the capital, is icebound for about two months. Rainfall averages 20 inches a year.

Most people of Sweden are descended from the ancient Vikings, and are fair-haired and blue-eyed. Most of them are Lutheran Christians. There are few large cities.

Sweden has large mineral deposits, including copper, iron ore, lead and zinc. More than half the country is forested. Timber from the forests is floated down the streams. From its timber Swedes make great quantities of matches, wood-pulp and paper. Some streams are harnessed for hydro-electric power.

Sweden is one of the world's leading shipbuilding countries, and it also has a large merchant fleet. The country specializes in making machine parts such as ball-bearings, and high-grade steel.

The south and east have the best farmland. Dairy farming is important, and cereals and vegetables are grown.

Sweden is a constitutional monarchy. It has a king, and the people elect a parliament, called the *Riksdag*.

Vikings who settled in Sweden and other parts of Scandinavia about 2,000 years ago formed a nation in the A.D. 800's. In the 1600's, Sweden became a major European power and dominated the countries around the Baltic Sea. Swedish influence declined after a disastrous war with Russia in the early 1700's. In 1815, after the Napoleonic Wars, Norway came under Swedish rule, but was partly in-

Facts and Figures
Area: 173,666 square miles.
Population: 8,093,000.
Capital: Stockholm.
Money Unit: krona.
Labour Force: 70% urban, 30% rural.
Exports: timber, paper, machinery.
Imports: coal, foodstuffs, petroleum.

dependent. Norway became completely independent in 1905. Sweden remained neutral during both world wars. In 1959, it joined the European Free Trade Association.

Swift, Jonathan (1667-1745), one of the most brilliant writers in English literature, was born in Ireland of English parents. His best known book is *Gulliver's Travels* (1726), which he wrote as a sharp piece of *satire* (humorous attack) on human nature and the customs of his day. It tells how the hero, Gulliver, was captured by strange people, such as the tiny Lilliputians and the giant Brobdingnags. Swift wrote many other stories and essays ridiculing social, political and religious views that he believed were wrong. He was also a poet.

Swift was born and educated in Dublin. He worked in England for 10 years as secretary to the statesman Sir William Temple, becoming active in politics and mixing with leading figures of the day. He returned to Ireland in 1699 as an Anglican minister, later becoming dean of St Patrick's Cathedral, Dublin.

And he gave it for his opinion, that whoever could make two ears of corn or two blades of grass to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together.

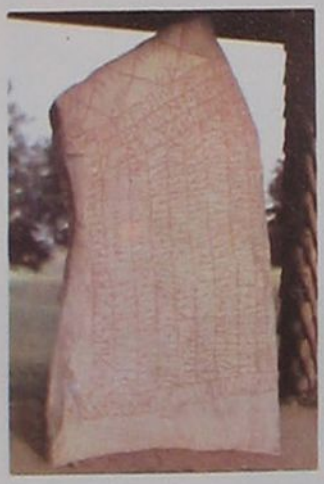
Jonathan Swift *Gulliver's Travels*

Swimming is a sport which provides perfect exercise for the whole body without undue strain. There are records of school swimming contests as far back as 1603 in Japan. However, competitive swimming as we know it originated in London, England, in 1837. Three freestyle events for men were included in the first modern Olympic Games. Olympic events for women were introduced in 1912.

Unlike animals, human beings have to be taught to swim. Swimming is best learned in a pool from a qualified instruc-

Left: Location map of Sweden.

Below: The harbour of the fishing village of Gravarne, Sweden.



Left: A rune stone at Rök in Sweden. Runes are the characters of an early Teutonic alphabet. The oldest runic inscriptions date from the A.D. 200's.

Below: A sulphate mill at Ångermanland. Sweden has great resources of minerals.

tor. He can teach proper breathing control and correct co-ordinated movements of the limbs. Being a good swimmer does not require great physical strength so much as efficient use of the body.

There are three basic types of swimming stroke: the *crawl*, the *breaststroke* and the *backstroke*. In the crawl, the arms enter the water alternately in an overarm movement and sweep under the body. At the same time the legs are kicked up and down in a 'flutter kick'. The crawl is the fastest stroke and is normally swum in freestyle events. In the breaststroke the arms are extended out in front of the swimmer and then swept round and down to the sides. The legs are kicked together from an opened position. Backstroke is similar to the crawl except that the swimmer lies on his back in the water and his arms rotate in the opposite direction.

The highest speed ever reached by a swimmer is 4·89 mph. This record was set by Stephen Clark (U.S.A.) at Yale University in 1964. In the 1972 Olympics Mark Spitz of the United States won seven gold medals (four individual and three relay). He had already won two gold medals in the 1968 Olympics, giving him a total of nine. The previous record for gold medals was five. Shane Gould of Australia won three individual gold medals at the 1972 Olympics and established three new women's world records in the process.

Australian swimmers play a ball game.

Switzerland is a mountainous country in central Europe. Because of its central position and the fact that it has been neutral since 1815, Switzerland is the headquarters of many international organizations and conferences. It is also a world centre of banking. Swiss banks are forbidden by law to give details of personal accounts to anyone, even the police. This policy has encouraged many people from other countries to deposit money with Swiss banks.

The country is bordered by France on

Above: Switzerland is famed for the beauty of its scenery and its villages and towns. These often nestle in valleys at the feet of high mountains and contain highly decorated wooden houses known as chalets.

Left: Location map of Switzerland.

Above: The alpenhorn is a long horn of wood which is used by Alpine cowherds. Its hollow note echoes round the mountains.

Below: Switzerland is also known for the quality of its dairy produce. A cheese-maker empties a pan of milk into a cheese vat in the Gruyère district. Gruyère cheese is known around the world.

the west, Germany on the north, Austria on the east, and Italy on the east and south. The Swiss are a mixture of the peoples of the surrounding countries. As a result, they speak several languages including French, German and Italian.

The Jura Mountains form Switzerland's north-west border. These mountains rise to about 5,000 feet above sea level. The mountain ridges are forested, and the valleys contain rich pasture land, used for grazing cattle in summer. South-east of the Jura range lies a central plateau, much of it between 1,500 feet and 3,000 feet high. Around the edge of this plateau are a number of beautiful lakes.

The Alps, Europe's highest mountains, lie south-east of the plateau. They cover nearly three-quarters of the country. They form a high 'wall' between Switzerland and northern Italy, with peaks over 15,000 feet high. Passes between the mountain tops carry roads from north to south, but snow often blocks them in winter. For this reason, a number of tunnels have been driven under the Alps.

A number of important rivers flow through Switzerland. The Rhône rises in the Alps and flows through Lake Geneva, while the Rhine flows down through Lake Constance. The swift rivers provide Switzerland with hydro-electric power.

Switzerland has warm summers on the plateau and the lower slopes of the mountains. But the upper parts of the higher mountains are never snow-free.

Apart from timber, Switzerland has few natural resources. But the Swiss are skilled craftsmen and engineers, and excel in precision work such as watch-making. Chemicals and textiles are other important industries. Tourism provides an important source of revenue. People come to ski in winter and to climb and admire the scenery in summer.

Switzerland formed part of the Roman Empire, and later on part of the Holy Roman Empire, a German-led confederation. In the late 1200's, people of three Swiss *cantons*, or states – Uri, Schwyz, and Unterwalden – banded together and declared themselves independent. They and the other Swiss cantons fought until the 1500's to make themselves completely free. At first, the 22 cantons of Switzerland were almost entirely independent of each other. Now, they have a *federal*, or central, government with an elected parliament and president. Switzerland is one of the most democratic countries in the world. Changes in the constitution have to be approved by a *referendum* (popular vote) before they can become law. In spite of a long tradition of democratic government, women were not allowed to vote in national elections until 1971.

Facts and Figures
Area: 15,491 square miles.
Population: 6,300,000.
Capital: Bern.
Money Unit: Swiss franc.
Labour Force: 42% urban, 58% rural.
Exports: chemicals, precision machinery.
Imports: foodstuffs, heavy machinery.

Sydney is the capital of the state of New South Wales and the largest city and principal seaport of Australia. The population of the city and its suburbs exceeds 2,590,000. Beautifully situated on the shore of Port Jackson Bay, its harbour, one of the finest in the world, extends inland for 18 miles. The world-famous bridge, carrying rail, road and pavements has a total length of 3,770 feet.

Sydney is the oldest city in Australia. Captain Arthur Phillip landed there in 1788 with a party of 700 convicts to establish a penal colony. He named the settlement after Lord Sydney, who was Home Secretary at that time. Much of the old part of the city was built by convicts between 1810 and 1830. Many buildings, including St James' Church and the Hyde Park Barracks (now used as the law courts) were designed by Francis Greenaway, a freed convict.

Sydney is a centre for education and about 5,000 students from Asian countries go there to study. The University of Sydney was founded in 1850 and provides higher education for over 16,000 students. The city is also the location of the University of New South Wales, founded in 1949. King's School, Parramatta was the first school in Australia. It is similar to a British public school.

The port of Sydney handles the bulk of Australia's exports of farm products. Many of the people work in the food processing industry. Other products include heavy machinery, motor cars, and textiles.

Sydney has many facilities for out-door recreation. There are many sports grounds for cricket, football and athletics. The sea around the city provides good opportunities for fishing and sailing. Sydney's magnificent Opera House was officially opened in 1973.

Symbiosis is a term used in biology to describe a situation in which two different kinds of organisms live closely together in a permanent association. The term

A view over Sydney's famous harbour, showing the great bridge and the new opera house, with its strange white sail-shaped structures.

symbiosis refers to those associations in which both partners derive some benefit.

The organisms involved in symbiosis may be two plants, two animals, or a plant and an animal. *Lichens* are good examples of symbiotic plants. Each lichen consists of a *fungus* (a plant such as a mould, without leaves or flowers and with no green colouring matter) and an *alga* (a very simple green plant). The fungus partner attaches itself to a rock or a tree trunk and provides shelter for the tiny algae. The fungus also provides certain minerals, which it absorbs from the surroundings. The alga provides carbohydrate foods that it makes through *photosynthesis* (the food-making process that is powered by the energy of sunlight and that goes on in the green parts of plants).

Another example of symbiosis occurs in cows, rabbits, termites, and other grass- and wood-eating animals. These have special cellulose-digesting *bacteria* (tiny plants) or *protozoa* (tiny animals) living in their intestines or stomachs. Without these little organisms, the animals would be unable to use their food.

More striking examples involve many of the large game animals, such as the rhinoceros and the buffalo, and a number of small birds known as tick-birds or ox-peckers. The birds run about on the backs of the animals and feed on the ticks and other parasites, thus helping the animals and getting good meals for themselves.

Syria is a country in south-west Asia. It borders the Mediterranean Sea in the west, and has an area of 71,228 square miles. Damascus is the capital and largest city. Syria's countryside includes rolling plains, mountain ranges, deserts, and fertile regions such as the Euphrates river

This map shows the location of Syria.

valley. The majority of Syria's 6,294,000 people are Muslims. Arabic is the official language. Farming and herding are common occupations. The country produces textiles. Its oil industry is growing. During its history Syria has been controlled by the Babylonians, Romans, Turks and others. In 1920, the League of Nations made it a French mandated territory. In 1945 it became independent.

Table Tennis is a sport which grew out of Ping Pong, an indoor version of Lawn Tennis popular at the turn of the century. It is played with rubber-covered bats and a white celluloid ball on a rectangular table, 9 feet long by 5 feet wide. A net 6 inches high is stretched across the middle of the table.

Points are scored when an opponent fails to return a ball, hits it into the net, or off the table. The winner of a game is the one who first scores 21 points or, at 20–20, is first to win two points more than his opponent. Three or five games normally constitute a match. Service changes every five points.

Doubles are also played on the standard sized table, each of the four players striking the ball in turn.

The first World Championships were held in England in 1926-7 when both the English Association and International Federation were formed. The first English world champion was Fred Perry in 1929, and a native-born Englishman did not win the title again until Johnny Leach in 1949 (who also won it in 1951). Since 1954, World Championship honours have been held by Japanese and Chinese players for whom Table Tennis is a leading national sport. World Championships, which include team as well as individual events for men and women, are now held every two years. Many countries hold international Open Tournaments, and there is now a European League competition.

A doubles table tennis match.

Tahiti is a tropical island in the south-central Pacific Ocean, belonging to France. It is one of the Society Island group, a part of French Polynesia. The island covers an area of 388 square miles. It is mountainous, volcanic in origin, and is encircled by a coral reef. The climate is warm and inviting, and the vegetation is lush. The Tahitians grow tropical fruits and vegetables and catch numerous kinds of fish. Tourism is the main source of income. There are about 61,500 Tahitians and they are mainly Polynesians and mixed Polynesian and French. Papeete, the port and only city of Tahiti, is the capital of French Polynesia.

The English navigator, Samuel Wallis, discovered Tahiti in 1767. Captain James Cook later visited and named the Society Islands. France made them a protectorate in 1843 and a colony in 1880.

Tanzania is a republic in eastern Africa. It has an area of 362,820 square miles. It includes the former British mandate territory of Tanganyika and the islands of Zanzibar and Pemba in the Indian Ocean. Tanzania contains the highest peak in Africa—Mt Kilimanjaro. Its wild life includes big game animals, such as elephants, lions, and zebras.

Tanzania's 13,200,000 people belong to a number of Negro groups. They speak

A location map of Tanzania. Three large lakes—Victoria, Tanganyika and Malawi (Nyasa)—lie along its borders.

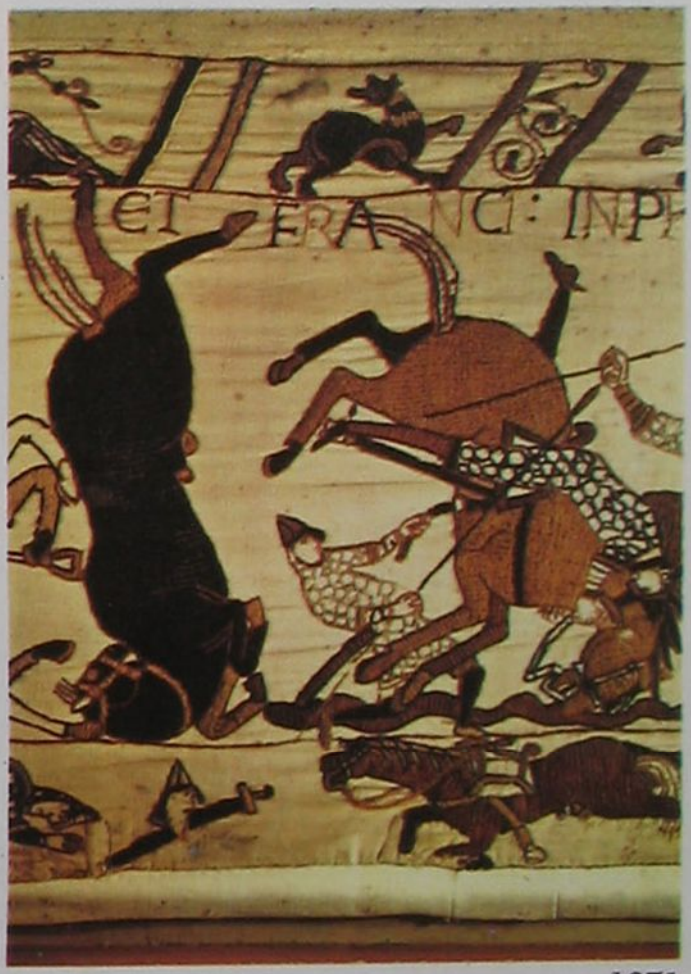
mainly Bantu languages. Most people live in villages. The port of Dar es Salaam is the capital and largest city. Tanzanian farmers grow cloves, coconuts, coffee, cotton, sisal, and tea. Diamonds and gold are the most valuable minerals. Tanganyika and Zanzibar united to form Tanzania in 1964.

Tapestry is a fabric made by hand to form a picture or decorative design. Most tapestries are hung on walls. For hundreds of years craftsmen have made colourful tapestries in the same way on a loom. They wind *weft* (horizontal) threads round the *warp* (vertical) threads, and press the stitches tightly against each other so that the weft covers the warp.

The greatest period of tapestry making was in the 1400's, when the craftsmen of Arras, in Flanders, produced work of superb quality. In the 1600's the Gobelin factory in Paris won great renown.

The 11th-century Bayeux Tapestry is probably the most famous, but is really a piece of embroidery. It shows scenes in the life of King Harold and the conquest of England by William the Conqueror.

Tapir The tapir is a mammal about the size and shape of a pig. Fully grown, it stands about three feet high. It is heavily built, and may weigh 400 pounds. It has heavy legs and a thick neck. Its snout ends in a short movable trunk. Tapirs live in the tropical forests and marshlands of south-eastern Asia and Central and South America. They are good swimmers, and feed entirely on twigs, leaves, fruit, and other plant food. Young tapirs are dark coloured with light stripes and spots, but they lose these markings.



Above: A detail from a tapestry showing a roe deer hunt, made at Tournai in Belgium in the 1400's. Tapestry making reached a peak at this time, and a few of this period still remain carefully preserved.
Right: The best-known 'tapestry' is probably the Bayeux Tapestry, made in the late 1000's. It is in fact not a tapestry but a great piece of embroidery. It may have been made by the wife of King William I, Queen Mathilda, and in France it is known as Queen Mathilda's Tapestry.

A South American tapir.

The middle parts and rump of the adult Asian tapir are white and the rest dark. The commonest American species is all brown.

Taranaki province lies on the west coast of New Zealand's North Island. It is bounded by Auckland to the north and east, and Wellington to the south and east. The area of the province is 3,705 square miles and its population is 101,000. It is named after the Maori tribe that once inhabited the region.

The south-west of Taranaki is a peninsula. On it is Mount Egmont (8,260 feet) which is a National Park. Most of the province is gently rolling pasture-land. The annual rainfall is high and there are many rivers and streams.

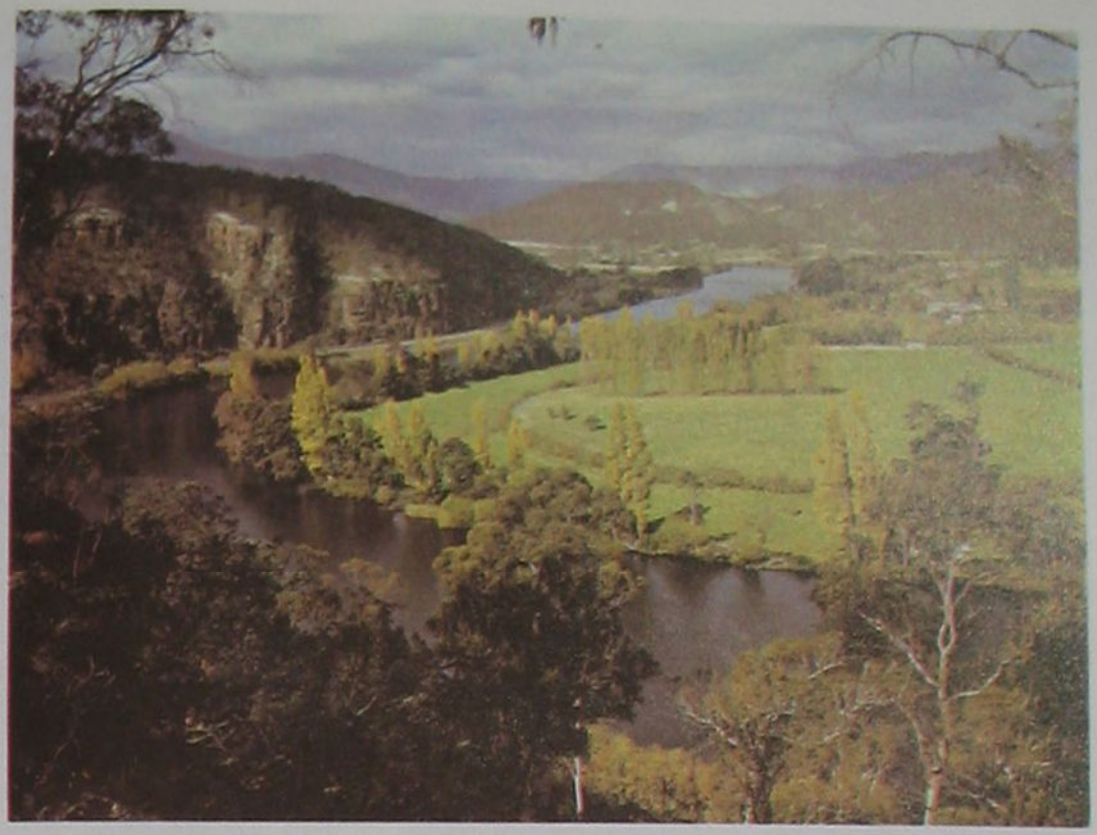
The heavy rainfall and fertile soil produce ideal conditions for dairy farming, the chief occupation. There is some light industry. Butter and cheese are the most important products. Some oil and natural gas are produced.

New Plymouth is the only city and major port of the province. Other important towns are Hawera and Stratford. All three lie in the southern half of Taranaki. Whalers first landed in 1828 and were followed in 1840 by settlers from Devon and Cornwall in England. In 1860, disputes with the Maoris over land ownership led to a series of battles known as the Taranaki Wars.

Tasman, Abel Janszoon (1603-1659), was a Dutch sailor who made two important voyages of discovery to Australasia.

Tasman was born in the Netherlands, and went to Java in 1633. In 1642, Anthony Van Diemen, the governor of the Dutch East Indies, chose him to lead an expedi-

Much of Taranaki is given over to dairy farming and the province produces a high proportion of New Zealand's butter on its some 3,000 dairy farms. The province's name comes from that of a Maori tribe.



Looking over the River Derwent from Pulpit Rock, New Norfolk, Tasmania.

tion to explore the lands of the unknown Southern Continent.

Tasman set sail from Batavia in 1642 with two ships (the *Heemskercel* and the *Zeahaen*). He sailed southwards and eastwards until he sighted the coast of Tasmania. He named it Van Diemen's Land but it was later renamed in his honour. From there, he continued westwards to the coast of New Zealand, which he believed was the edge of the mysterious continent he sought. He then sailed northwards in the Pacific Ocean, hoping to rediscover the Solomon Islands, but instead found other islands. He returned to Batavia 10 months after starting out.

The council that had commissioned the voyage were disappointed at the results because they felt Tasman had found nothing of value. Nevertheless, in 1644, they sent him on a second trip, during which he succeeded in mapping much of the Australian coast.

Tasmania is a large island which is part of Australia. The shallow waters of the Bass Strait separate the island from the mainland. The shortest distance from Tasmania to the mainland is 124 miles. Tasmania is the smallest state of Australia. It has a pleasant, mild climate and fine scenery and beaches and many Australians spend vacations there. The island's capital and largest city is Hobart. Two rare animals live on the island but not on the Australian mainland. They are the Tasmanian Devil, a savage, bear-like animal, and the almost extinct Tasmanian wolf.

Together with several small, offshore islands, Tasmania covers an area of 26,383 square miles. Much of the land is mountainous, especially in the west where Mt. Ossa, the island's highest peak, rises to 5,230 feet above sea level. Tasmania also has a few broad plains where farming is important. The entire island is well-watered. About 40 to 60 inches of rain falls every year in the west and 20 to 40 inches falls in the east. As a result, Tasmania has many rivers and lakes, some of which are used to produce hydro-electric power.

Most of Tasmania's 395,000 people are of British descent. The Aborigines, who once lived there, were either killed or deported by the British in the 1800's. Today, about a third of all Tasmanians live

A location map of Tasmania.

in the capital, Hobart, and another third live in other cities and towns, including Launceston, Devonport, Burnie and Queenstown. Many townspeople work in manufacturing industries or for the government. Tasmania has some rich farmland. It is sometimes called the *apple island*, because it produces about a third of Australia's apple exports. Other farm products include hay, oats, potatoes and wheat. Tasmania also has large forests and timber products are important exports. Valuable minerals include copper and zinc.

Tasmania was discovered in 1642 by a Dutch explorer, Abel Janszoon Tasman, who named the island Van Diemen's Land. Britain took over the island in 1803 and settled convicts there until 1853. In 1855 the island was renamed Tasmania and, in 1901, it became part of Australia.

Taxation Every government needs to have a large amount of money to be able to carry out its duties properly and to provide the services that a country needs. A government's main source of *revenue* (income) is taxation. Taxes are contributions that the people of a country pay to their government to make it possible for the government to administer the country's affairs.

There are two main kinds of taxation, *direct taxation* and *indirect taxation*. Direct taxes are those that individuals or firms pay directly to the government. Income tax, which is paid by individuals from their incomes, and corporation tax, which is paid by companies, are direct taxes. Income tax is one of the most important examples of direct taxation, and is the major source of revenue in many countries.

Indirect taxes are taxes on goods and services, such as value added tax, customs duties and excise duties.

In addition to raising revenue, governments use taxation to regulate the economy of the country. Some taxes are levied to change the distribution of wealth in the community. Many countries use a system of taxation under which a person earning a low wage pays proportionately less than a person who has a large yearly income.

People who inherit a large amount of money or property on the death of the owner have to pay *estate duties*. In some countries, rich people pay *wealth tax* on the assets they own during a tax year.

Taxes paid by occupiers of buildings and land to local authority, such as a borough or a county council, are called *rates*. Each building and piece of land in the local authority's area has a *rateable value*. Each year the local authority decides the rate for the year. If, for example, a council fixes a rate of 50 pence for each £1 of rateable value, the occupier of a house which has a rateable value of £100 will have to pay 5,000 pence (£50) as rates for the year.

Talking points

* In most countries, governments tax rich people at a higher rate than poorer people in order to distribute wealth more evenly over the community. Do you support this type of taxation?
* Indirect taxation can be used to promote social policies. For example, a heavy tax can be put on cigarettes to discourage smoking. Discuss which items you would tax either heavily or lightly.
* Some people resent paying tax because they have no control over the way in which the money is spent by the government. To what extent should taxpayers be able to determine how the money is spent?

Articles to read

Banking; Government; Money; Smuggling.

Tchaikovsky, Peter Ilitch (1840-1893) was a great Russian composer whose music is among the most popular of all time. Famous for its haunting melodies, Tchaikovsky's music could also be gay or forceful. His ballet music for *Swan Lake*, 1876, *The Sleeping Beauty*, 1890, and the

Nutcracker, 1892, has been universally popular ever since it was written.

His six symphonies contain some of his finest music. The sixth and last symphony is usually called the *Pathetique*, and it is characteristic of the melancholy side of the composer's nature. He also wrote other symphonic works and eleven operas, of which *Eugene Onegin* and *The Queen of Spades* are the best-known. His great violin concerto, *Concerto in D*, was composed in 1878. He wrote three piano concertos, of which the last remained unfinished at his death. Tchaikovsky also composed many fine piano pieces and songs. One of his most famous works is the *1812 Overture* (composed in 1880), which commemorated Napoleon's defeat by the Russians.

Tchaikovsky was born at Kamsko-Votinsk in Russia. He at first studied law. But after three years as a clerk in the Ministry of Justice, he began to study music in St Petersburg. Between 1866 and 1877, Tchaikovsky was a professor at the Moscow Conservatory. He then concentrated on composing until he died.

Tea is a drink made from the dried and cured leaves of the tea bush. It is a popular drink in Britain, Russia, China and Japan. Tea contains *caffeine* (a mild stimulant) and *tannin*.

Tea bushes are grown mainly in India, Ceylon and China. As the pickers move among the bushes, they pick and sort the various kinds of leaves. Young leaves make the best tea. From the plantation, the leaves go to a factory to be cured. Curing the leaves in a firing machine stops them from fermenting. This process produces *green tea* or *China tea*. *Black tea* or *India tea* is made by letting the leaves ferment before firing them.

When tea-drinking first began in England large quantities were made at one time and kept in barrels. When some was wanted it was drawn off and heated. Then the Chinese way of making it in a pot was introduced; and modern pots are still very like the old Chinese ones. Among Western countries, Great Britain drinks by far the most tea.

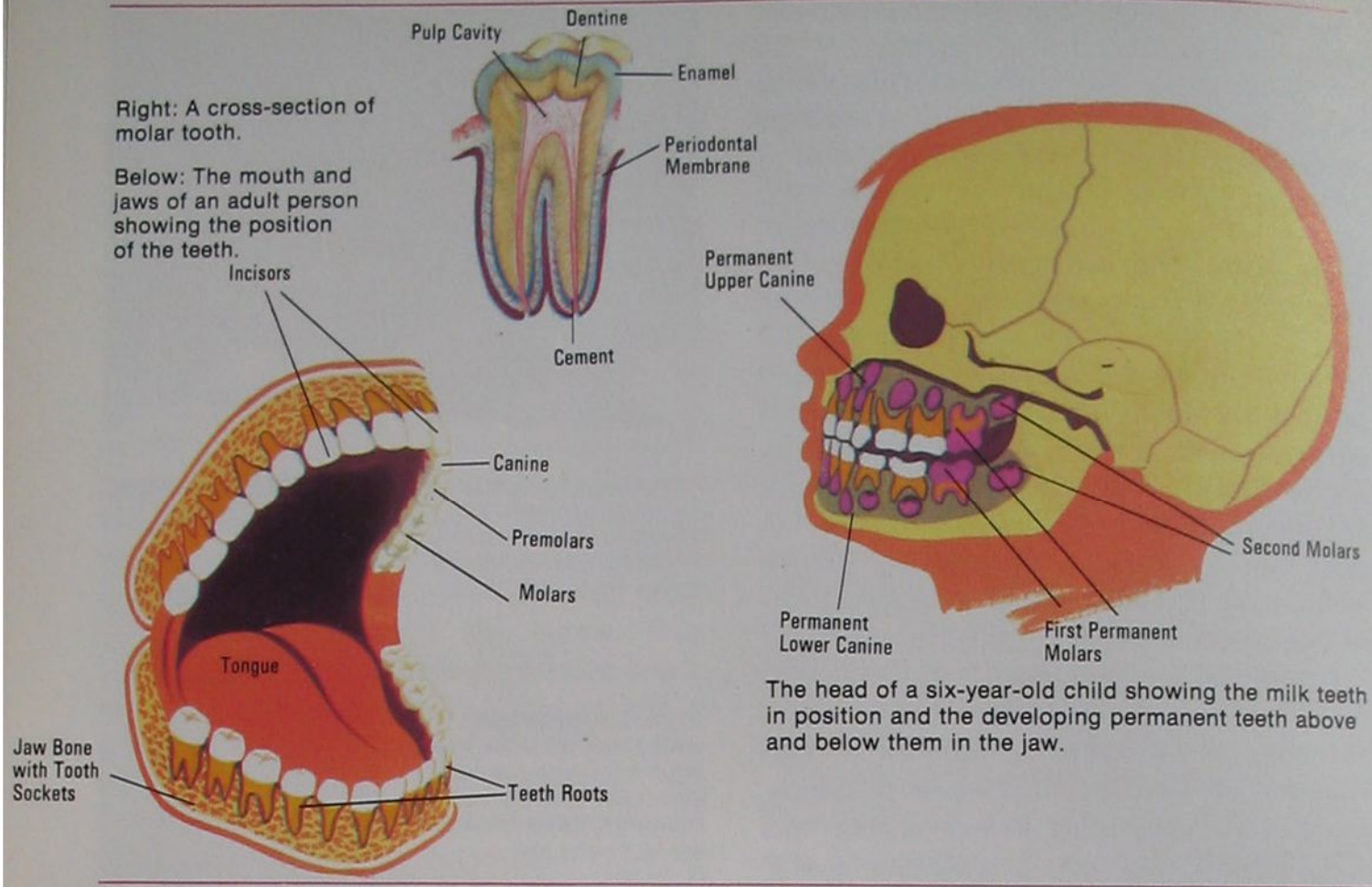
Above: Loading sacks of tea on to a lorry at the plantation for transport to the factory where the tea leaves are cured.

Right: Tea chests are sealed with an inner lining of tin foil to prevent contamination of the cured tea during its journey from the factory to the customer.

Teeth are hard, bone-like growths in the upper and lower jaws of most vertebrate (backboned) animals. Their job is to cut, break up, and chew food. Many animals also use their teeth as weapons to kill their prey.

An adult human being normally has 32 teeth, 16 in each jaw. There are four main types, differing in size and shape according to their use. There are eight *incisors*, four in each jaw. They are our front teeth – sharp and chisel-like for cutting off pieces of food. Behind these are the four *canine* teeth, one on each side, top and bottom. They are sharp and fang-like and are used for tearing food, especially meat. They are particularly well developed in flesh-eating mammals such as members of the cat and dog families. Plant eaters such as rabbits, on the other hand, may have no canine teeth at all.

Incisors and canines have the job of getting conveniently sized pieces of food



The head of a six-year-old child showing the milk teeth in position and the developing permanent teeth above and below them in the jaw.

into the mouth. The other teeth, *premolars* and *molars*, then break it up and chew it. Chewing movements cause the teeth to act like millstones, grinding up the food. An adult human being has altogether 8 premolars and 12 molars. The premolars are smaller than, and in front of, the molars.

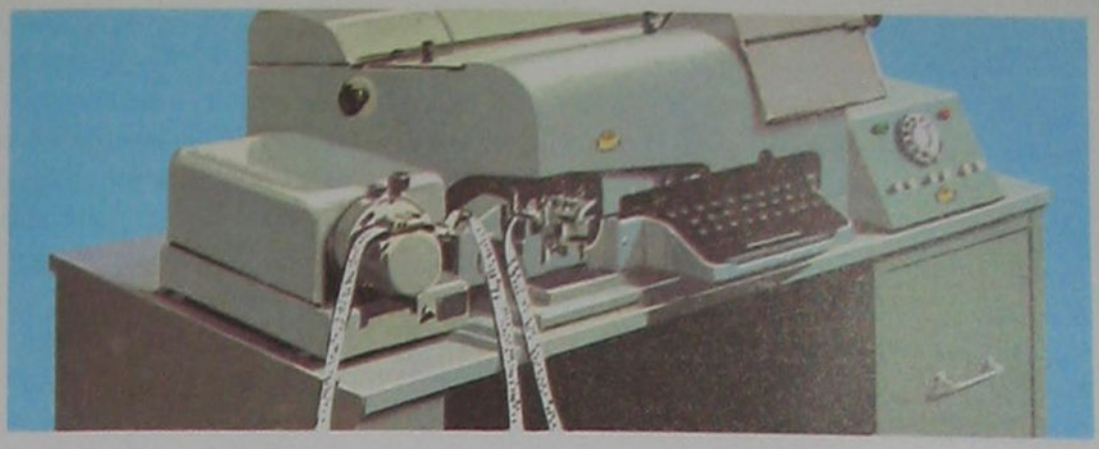
In spite of their varying shape, all teeth have the same basic structure. The part projecting above the gum is the *crown*. Embedded in the gum and reaching down into a socket in the jaw-bone is the *root*. The body of the tooth is made of a hard bone-like material called *dentine*. Inside this is the *pulp cavity*, which contains blood vessels and nerves. Hard *enamel* covers the crown, but around the root is a layer of *cement*, which holds the tooth firmly in place. Food that is not removed from crevices in the teeth decays, producing acid that attacks the enamel. This is the first stage of tooth decay. If teeth are neglected, they will quickly begin to suffer from decay. For this reason it is most important to brush one's teeth regularly and to pay frequent visits to the dentist.

We have two sets of teeth during our lifetime: *milk* teeth, which appear between the first 6 and 24 months of life; and *permanent* teeth, which grow from the age of about 6 years until the 20's.

Tehran is the capital of Iran, and one of the most important cities in the Middle East. It has a population of 3,150,000. The city is situated in northern Iran, at the foot of the Elburz Mountains. It was greatly modernized after 1925 by the ruling shah. Industries include textiles, carpets and chemicals.

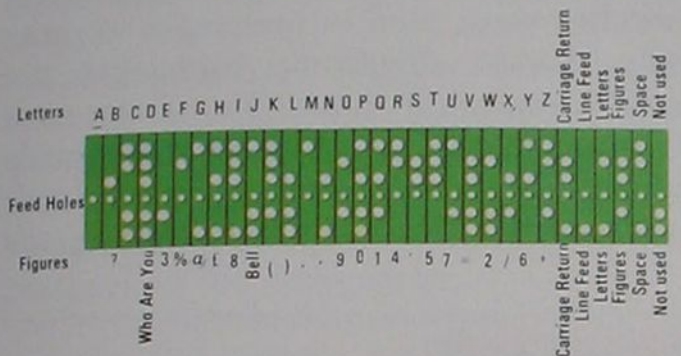
Tehran was founded in the early 1200's and became the capital of Persia in 1788.

Telegraph In its simplest form the electric telegraph consists of a battery and a morse key at the sending end, a buzzer at the receiving end, and a pair of wires connecting the two ends together. When



Right: A Telex machine for sending telegraph messages.

Below: The five-position punch-tape code has only 32 combinations of holes, too few to represent all the letters and figures etc. Each combination represents *two* symbols, e.g. the code for Q is the same as that for the number 1. Two codes have only one meaning each: whether the following codes represent letters or figures etc.



the key is depressed it connects the battery to the two wires and an electric current flows through them to the buzzer which emits a high pitched buzz.

Messages can be sent by depressing the key for short and long periods using the *Morse Code*. The letter A can be sent by depressing the key for a short period, releasing it and depressing it again for a long period. The letter E can be sent by depressing the key for one short period (known as a dot), the letter M by depressing it for two long periods (known as dashes).

A skilled operator is needed to send and receive Morse signals and today automatic machines known as teleprinters have largely replaced human operators. These machines use a special code known as the *Murrey Code*. They have a keyboard just like that of a typewriter except that there are also keys marked 'carriage return' and 'line feed'. When a letter key such as A is depressed, the code signals for that letter are sent along the wires to a teleprinter at the receiving end. There a wheel with all the letters of the alphabet around its rim is rotated until the letter A is at the top. A hammer then strikes the A and it is printed on a page. Before typing a new line the operator depresses the line feed key which moves the page on the distant teleprinter up a line. She then depresses the carriage return key which moves the paper over to the left hand side ready to start the new line.

Today, teleprinters in business offices are connected into an international network known as *Telex*. Any teleprinter can be connected to any other teleprinter by dialling its number on a telephone dial—just as when making a telephone call. To save time and money, the teleprinter operator frequently types out the message beforehand onto a punched paper tape. This tape is then fed into an *autotransmitter* which sends the message to the teleprinter at the far end of the wires.

Telephone A telephone handset contains a *bell*; a *microphone* which converts our voice into an electrical signal; an *earphone* which converts incoming electrical signals back into speech; and a *dial* which we use to send electrical pulses along the line to the automatic exchange.

When we pick up the handset a *uniselector* in the exchange searches for and connects our phone to a free set of automatic selector equipment. We then hear the *dialling tone*. When we dial the first number the equipment connects

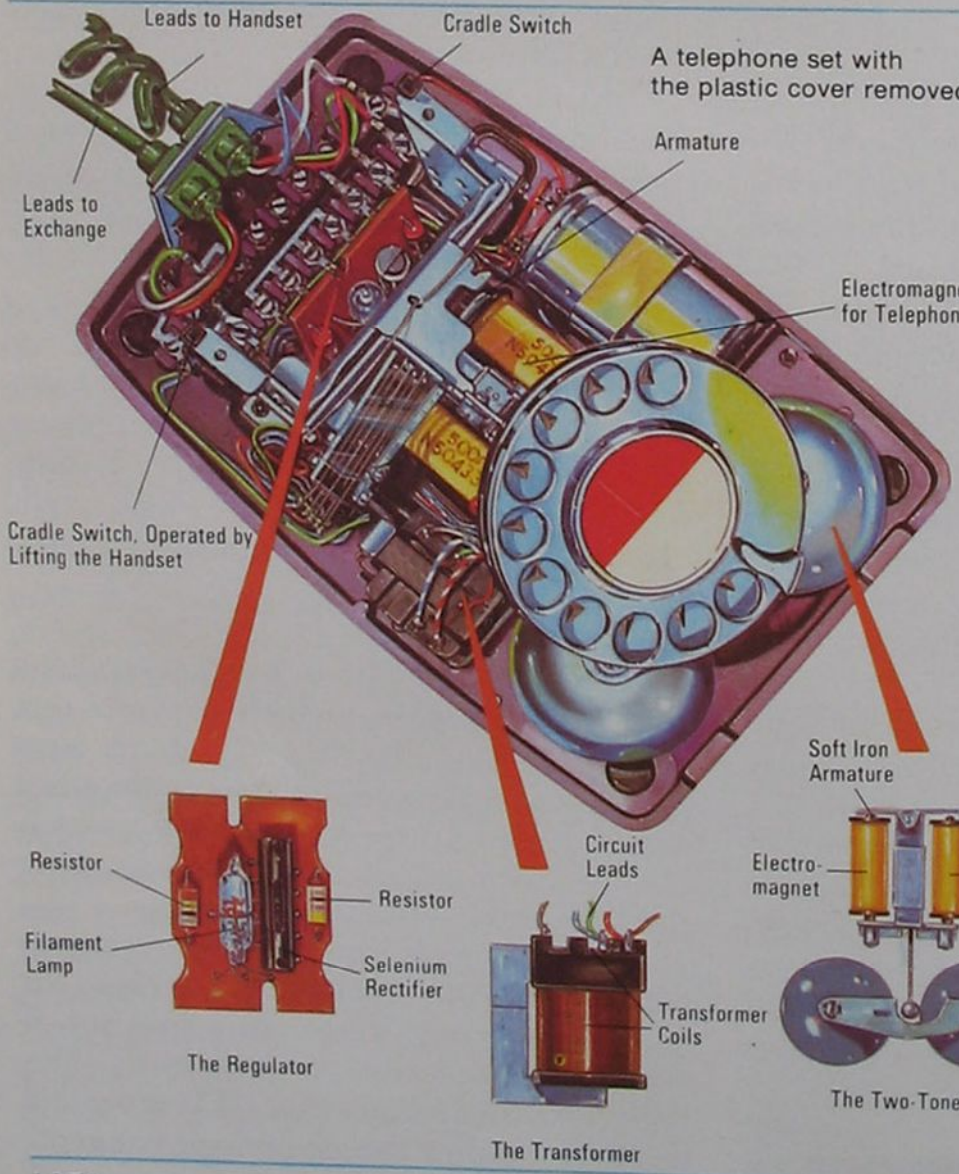
us to an outgoing *junction* cable linked to the exchange we want, or to a junction cable going in the direction of the wanted exchange if it is a distant one that has to be reached via intermediate exchanges.

When the wanted exchange is reached, we dial the number we want on that exchange and the equipment there connects the wires from our phone through to the phone we want. At the same time, a low frequency current known as the *ringing current* is sent along the wires to the phone we wish to contact. A similar current is sent back over the wires to us and we hear the *ringing tone.*

The ringing current operates the bell in the handset of the person to whom we wish to speak. When he lifts his handset to answer, both ringing current and ringing tone are disconnected and we can speak to him. If his phone is already in use the wires from our phone are not connected through to it. Instead, an interrupted current known as the *engaged tone* is sent back over the wires to us.

Today, long complex strings of numbers are often needed to route a call through the many intermediate exchanges. It is now common practice to dial a quite simple number which is converted into the full number by automatic equipment in the local exchange.

Until recently, electromechanical switches were used in exchanges to route calls. Today, electronic exchanges are rapidly replacing them. One of the most exciting of the new techniques made possible by electronics is *pulse code modulation (PCM).* Conversations are



Telephone signals may have to travel a long way from the caller to the receiver. The signal becomes fainter with distance, as more power is used up in overcoming the resistance of the telephone wires. Thus the strength of the incoming signal may vary. The *regulator* in the telephone set maintains the voltages supplied to both the microphone and earphone at a constant level.

The *transformer* isolates the microphone from the earphone. It also ensures that speech signals are transmitted along the line at maximum power.

In the bell, a current flows alternately through the two electromagnets, causing the armature to move to and fro. The clanger is connected to the armature and vibrates, sounding the bell. The two bells produce different notes.

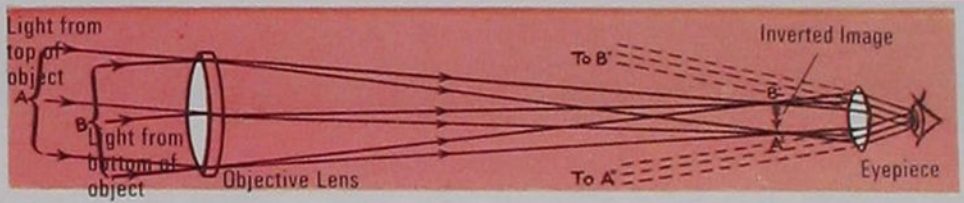
'sampled' 8,000 times a second and only these samples are sent over the wires instead of the full conversation. Already the samples from up to 24 conversations can be sent over the wires that would normally carry only one conversation and the capacity of the telephone system is greatly increased.

Telescope A telescope is an instrument that makes distant objects seem nearer. It does this by forming an image (picture) of the object being viewed, and then *magnifying* (increasing the size of) this image.

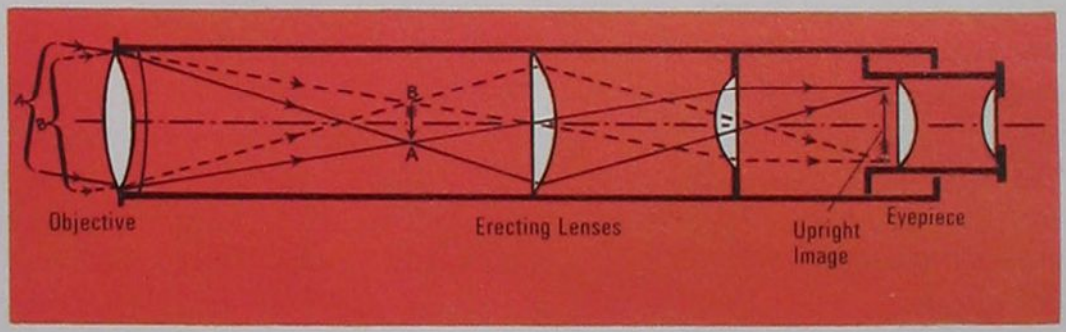
Telescopes have enabled astronomers to study not only the well-known stars and planets but also many other heavenly bodies that are invisible without a telescope. The telescope is thus of great importance to the astronomer.

There are two main kinds of telescope, *refracting* and *reflecting* telescopes. Refracting telescopes are the more familiar kind and were the first to be invented. A simple refracting telescope consists of a tube with a large convex lens (called the *object glass*) at one end, and a smaller, magnifying lens (the *eyepiece*) at the other. The object glass collects light from the object, and forms an image of it inside the tube. The eyepiece then magnifies this image. The distance between the object glass and the eyepiece can be adjusted to make the image sharp. This is called *focusing* the telescope.

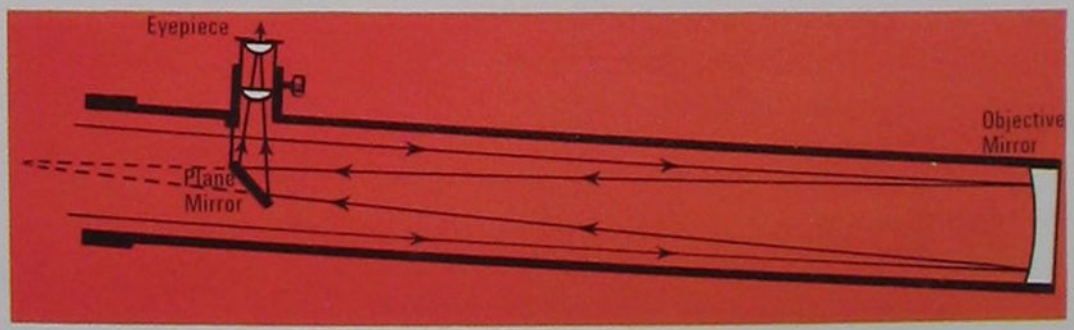
Through this kind of telescope things look upside down. This does not matter to the astronomer. To turn things the right way up another lens is needed inside the telescope, which is then called a *terrestrial telescope*.



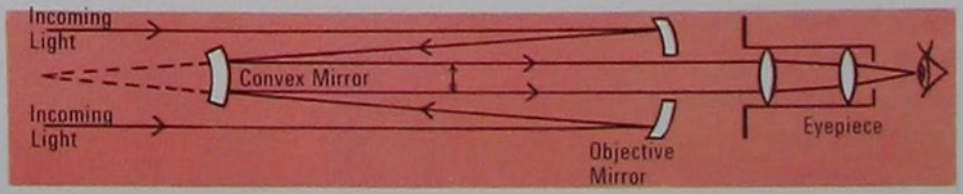
An astronomical refracting telescope produces a magnified and inverted image.



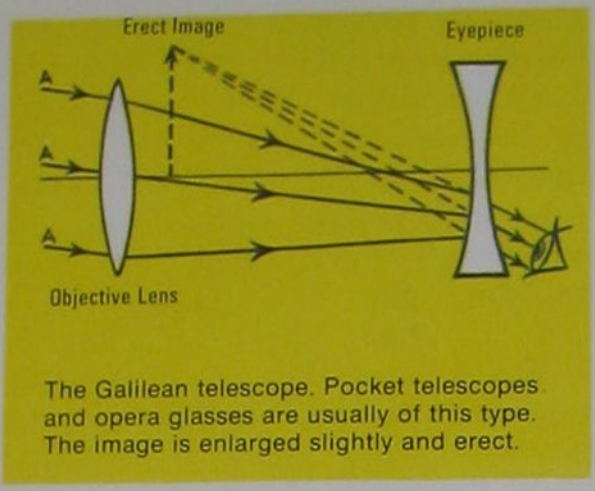
A terrestrial telescope gives an enlarged upright image. The inverted image produced by the object lens is turned right way up by erecting lenses and viewed through the eyepiece.



The Newtonian telescope. A small plane mirror turns an image produced by the objective mirror into the eyepiece. Most large reflecting telescopes are of this type.



A Cassegranian telescope is a reflecting telescope. The main mirror has a hole at its centre to allow the light to pass to the eyepiece.



The Galilean telescope. Pocket telescopes and opera glasses are usually of this type. The image is enlarged slightly and erect.

Refracting telescopes have one big disadvantage. When light passes through a lens it may be distorted. In 1663 James Gregory suggested using mirrors instead of lenses, and in 1668 Sir Isaac Newton made the first satisfactory reflecting telescope.

The reflecting telescope has a large concave mirror at one end which collects light from the object being studied, and reflects it onto a plane (flat) mirror farther up the tube. The plane mirror then reflects the light through the side of the tube and forms an image close to the eyepiece, which magnifies it. Reflecting telescopes have fewer disadvantages than refracting telescopes because the light does not have to pass through an objective lens. Today most large telescopes in observatories are reflecting telescopes.

Another kind of telescope is the radio telescope used by astronomers. This is not really a telescope, but a huge radio aerial. (See Radio Astronomy.)

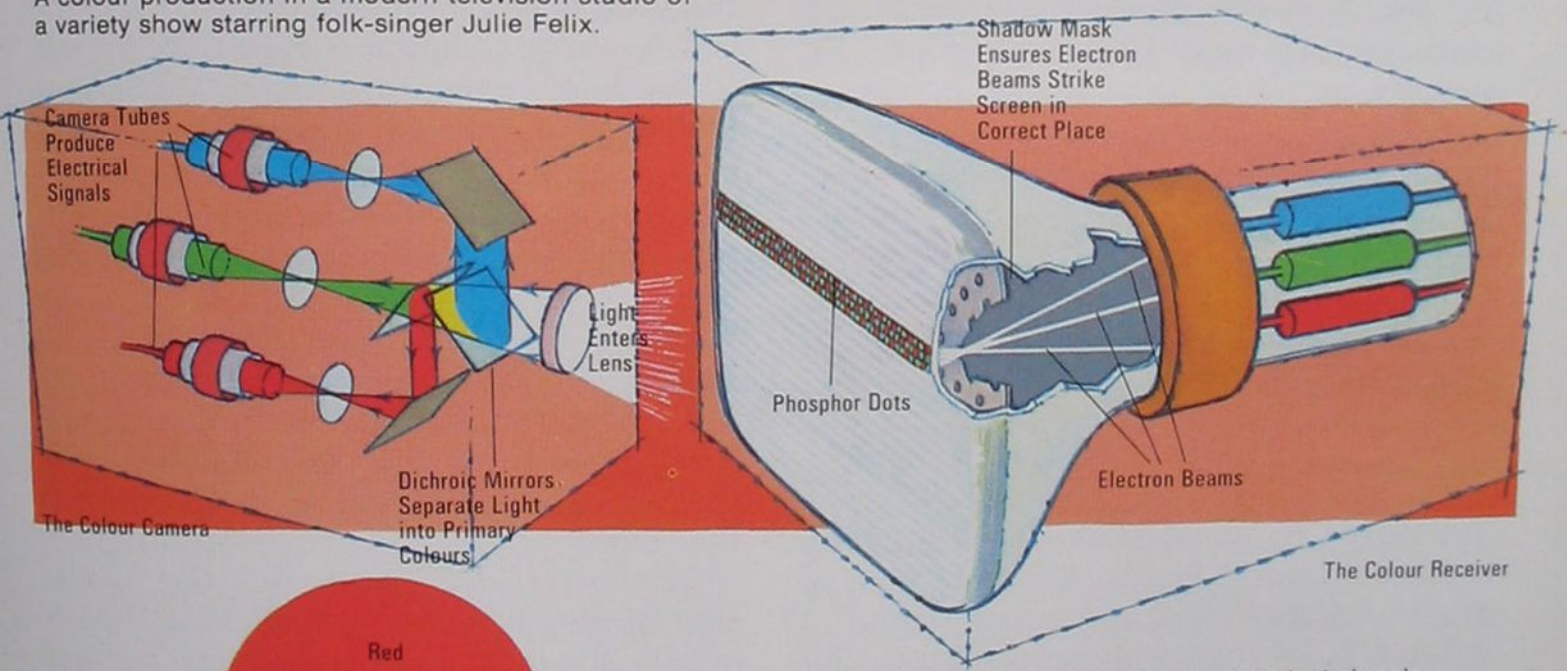
Television Before moving pictures can be transmitted by a TV broadcasting station they must be converted into electrical signals. The early experimenters very quickly realized that there was no economic way of transmitting the whole of each picture in one go. To overcome this they hit on the idea of dividing each picture up into a number of small areas and transmitting the light value, or degree of brightness, of each of these areas one at a time. In the TV receiver, a beam of electrons strikes a coating of *phosphors* on the screen and the coating glows. The beam travels rapidly over the screen, so that each of the areas is reconstructed in its correct place and at the appropriate brightness, and the viewer sees the complete picture.

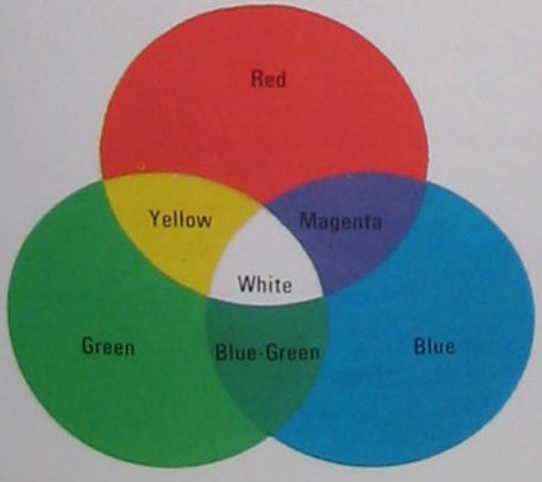
To convert the light value of each area into an electrical signal we make use of the *photo-electric effect*. Certain metals, including selenium, produce an electric potential when light falls on them. The picture is scanned electronically by a system that looks at a small area of the picture at a time. Scanning begins in the top left hand corner of the picture. In a simple system the light from the top left hand corner of the picture falls onto a cell containing selenium, which sends a current to the transmitter that is proportional to the brightness of that part of the picture. The scanning system then moves along the top of the picture until it reaches the right hand corner. It is then switched off and moves rapidly back to the left hand side of the picture to a point just below its original starting point. It is then switched on again and moves along to the right hand side of the picture following a line just below the first one. The process is repeated until the bottom of the picture is reached.

In modern TV cameras the scene to be televised is focused by a lens onto an array of photo-electric elements. Scanning is carried out by a beam of electrons. In the United States the picture is divided up into 525 horizontal lines and 30 complete pictures are transmitted each second. In most of Europe the number of lines is 625 and there are 25 complete pictures a second. The United Kingdom has gradually changed over to 625 line standard from the earlier standard of 405 lines and 25 pictures.

There are three separate camera tubes in a colour TV camera. Special mirrors split up the light from the scene

A colour production in a modern television studio of a variety show starring folk-singer Julie Felix.


Camera Tubes Produce Electrical Signals
Light Enters Lens
Dichroic Mirrors Separate Light into Primary Colours
The Colour Camera
Shadow Mask Ensures Electron Beams Strike Screen in Correct Place
Phosphor Dots
Electron Beams
The Colour Receiver



Colour Television. In the camera, electrical signals produced by each of the three primary colours are produced. The receiver sorts out these three signals and actuates electron beams that cause dots of phosphors in the screen to glow red, green or blue accordingly. The coloured dots make up a colour picture.

The three primary colours of light are red, green and blue. All other colours can be made by combining light of these three primary colours.

into its red, green and blue components, and direct each component into its tube. In the TV receiver the signals that have come from each tube control three beams of electrons. One beam is adjusted to strike dots of phosphor on the face of the *cathode-ray tube* in the receiver that glow red. The second beam strikes dots that glow green; the third one strikes dots that glow blue.

Scanning is carried out in the same way as in black and white TV. There are over one million phosphor dots, and the viewer sees a full colour picture which if examined in detail under a microscope is seen to be made up of many small glowing red, blue and green dots.

There are not enough TV channels to allow each colour signal to be transmitted in its own channel. Instead, all three signals are transmitted in one channel using in the United States a highly sophisticated system known as N.T.S.C. Slightly different systems known as PAL and SECAM are used in Europe. All the systems produce a black and white picture on a black and white TV receiver.

Talking points

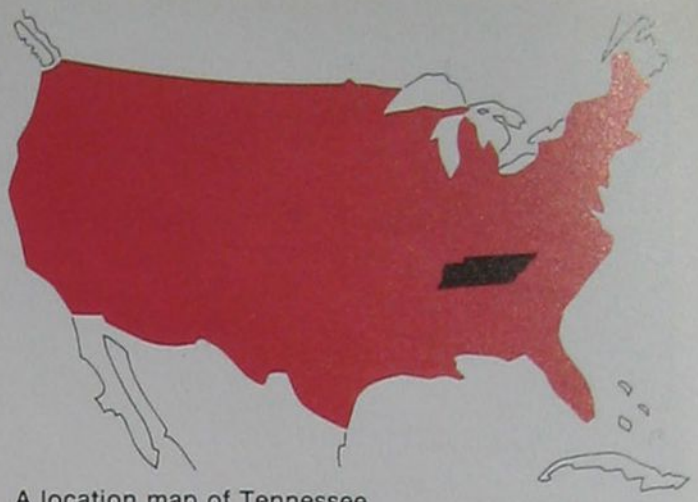
* Television has become very popular over the past twenty years and is an important form of enjoyment to many millions of people. Discuss what effects television has had on modern life.
* Discuss whether a non-commercial TV station, such as the B.B.C., which is paid for by licences, has any advantages over a commercial station which relies on selling advertising time for its income.
* Television has more power to influence the way people think than any other media, i.e. radio and newspapers. What safeguards do you think are necessary to prevent television companies from abusing this power?

Articles to read

Advertising; Communications.

Tennessee is a well wooded state in the southern United States. It has an area of 42,244 square miles, and a population of 3,924,000. Once mainly agricultural, the state still produces cotton, tobacco, farm livestock and horses. But the main source of income today is the manufacture of chemicals, machinery and metal goods, processed food and textiles.

Tennessee presents a variety of land features. Much of the central and western part of the state is fertile farming country.



A location map of Tennessee.

In the east are the Appalachian Mountains. The state has three important river systems—the Cumberland, Mississippi and Tennessee.

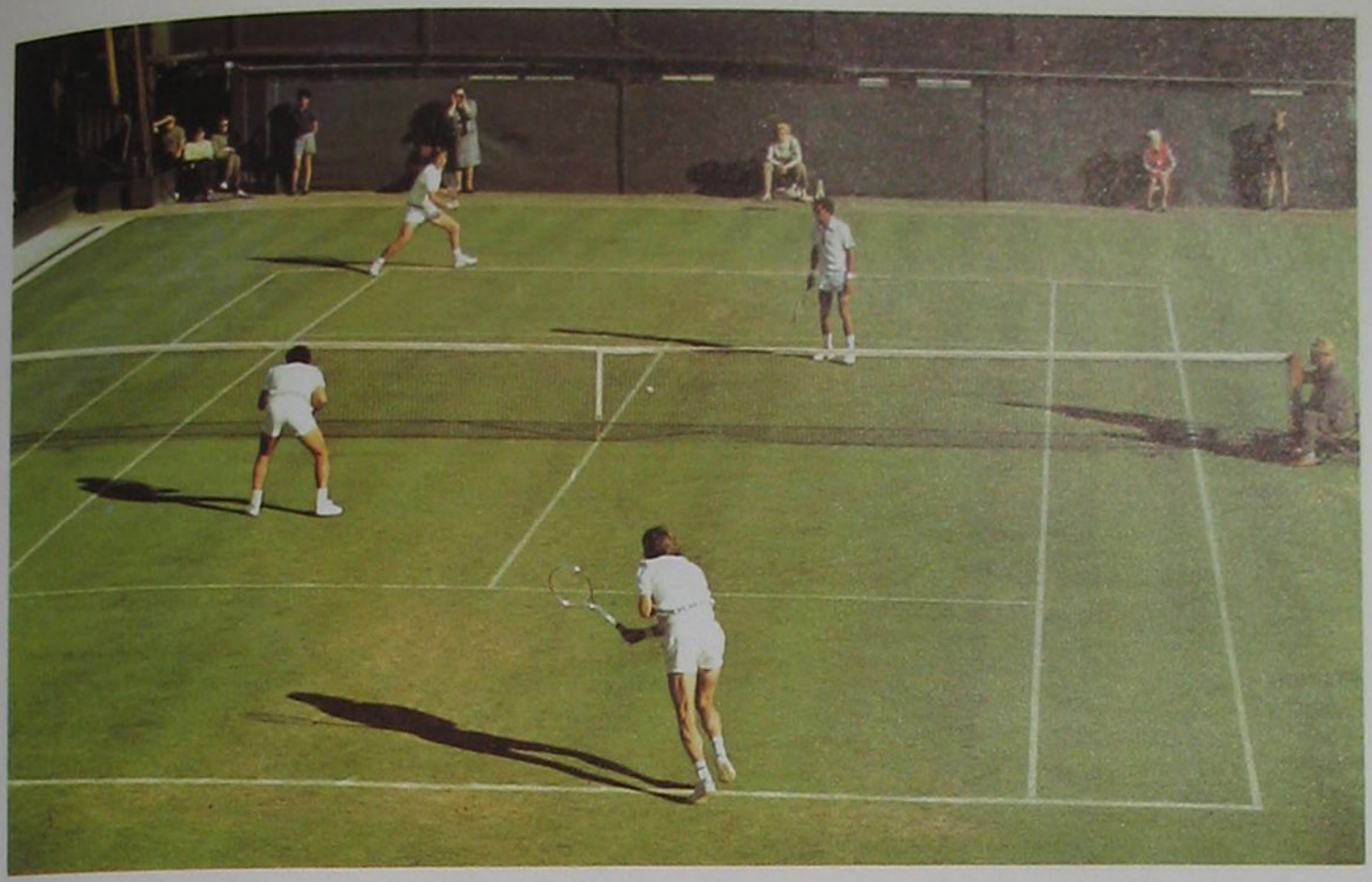
Spanish, French, and British explorers came to the region in the 1500's and 1600's. The favourable reports of Daniel Boone and other scouts attracted settlers. By 1763, the area was under British control. Statehood came in 1796. During the Civil War, sympathy was divided, but the state finally joined the South.

Tennessee's capital is Nashville, known as the home of country music. The largest city is Memphis. Chattanooga and Knoxville are industrial centres. Oak Ridge, where parts of the first atomic bomb were produced, has an atomic energy museum.

Tennis probably originated with 'le Paume', a game played in France in A.D. 1300 by batting with the gloved hand a cork, or hair ball covered with leather, over a mound of earth about 3 feet high.

Modern Lawn Tennis was the invention of Major Walter Wingfield, a British army officer who patented his version called Sphairistike in 1874. The Lawn Tennis Association was formed in 1889, taking over all rights for the laws, and it remains the governing body in England. The first All England, or Wimbledon, Championships were held in 1877.

Although originally intended to be played only on grass, Lawn Tennis is



A doubles match during the 1972 Wimbledon championships. Ashe and Ralston are playing van Dillen and Smith, the defeated finalists.

now played on hard courts of varying material, and indoors on wood as well as on grass in most parts of the world.

It is a racket-and-ball game for two or four players of either sex. A singles court measures 78 feet by 27 feet. A doubles court is 9 feet wider. Dividing the court across its width is a net 3 feet high at its centre.

Each player has a racket; a wooden or steel frame about 2 feet long with a handle, and an oval head strung with nylon or catgut. The weight is about 12-14 ozs. With this he hits a rubber ball, covered in felt, a maximum 2½ inches diameter, weighing about 2 oz. The object is to score points by forcing an opponent to miss the ball, hit it after it has bounced twice, hit it into the net, or beyond the boundary lines marked on the court.

The first point for each player is called '15', the second '30', the third '40' and the fourth is game. A score of 40-40 is called 'Deuce', when a player must win the two points immediately following the score at Deuce to take the game. The first to win six games wins a set, providing he then leads by at least two games—otherwise the game continues until one player gains such a lead. Men's matches are usually 'best of five sets', women's 'best of three'. At one time a set continued until one of the players was two games ahead, which led to long and exhausting matches. To prevent this the *tie-break* has been introduced. The tie-break comes into operation in all but the last set of a match when the score reaches six-all or eight-all. The player who first wins seven points wins the game and set provided he leads by two points; if the score reaches six-all the game goes on until a two-point lead has been gained. Numerical scoring is used in a tie-break game.

'Real' or 'royal' tennis, the English version of Jeu de paume, is still played in England, France, and the United States. It takes place in a walled court and has scoring similar to that of lawn tennis, but the rules are quite different and very complicated.

Tennyson, Alfred (1809-1892), was probably the most successful poet of Victorian England. He became poet laureate on the death of Wordsworth, in 1850, and was made a baron in 1884.

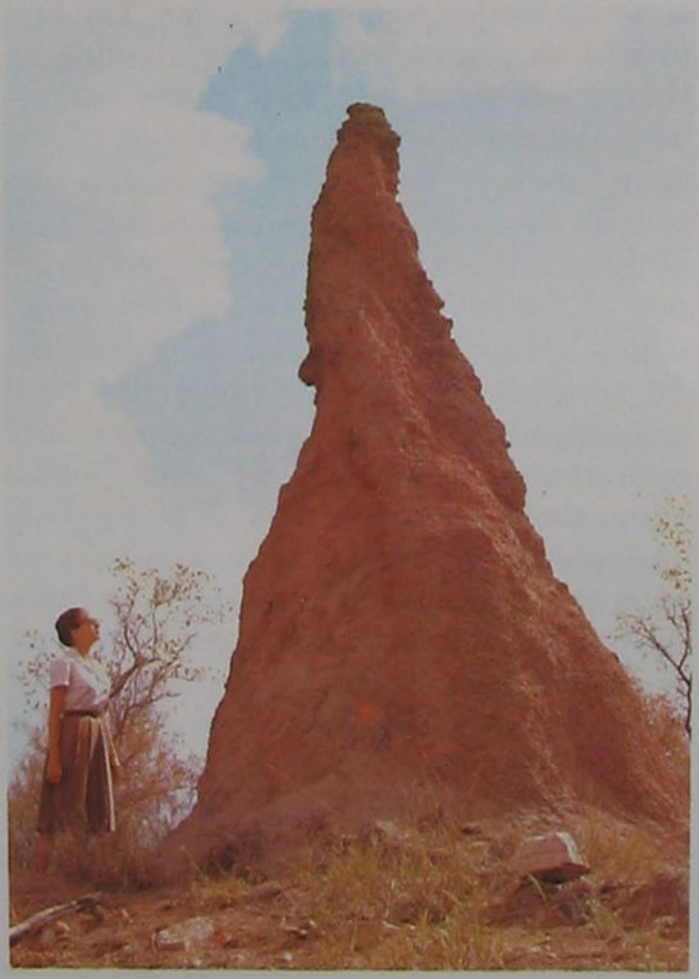
Tennyson's verse is expertly written and musical, but his fine-sounding phrases sometimes grow monotonous. Among his best known works are *In Memoriam* (1850), a meditation on the death of his close friend Arthur Hallam; *The Charge of the Light Brigade* (1854); and *Idylls of the King*, episodes in the life of King Arthur, published periodically between 1859 and 1889.

He clasps the crag with crooked hands;
Close to the sun in lonely lands,
Ring'd with the azure world, he stands.
The wrinkled sea beneath him crawls;
He watches from his mountain walls,
And like a thunderbolt he falls.
Alfred, Lord Tennyson *The Eagle*

Termites are insects resembling ants in appearance and behaviour. Termites are often called 'white ants', but they are not close relatives of ants.

Termites live in huge colonies, often in great nests made of soil cemented with saliva. The inside of the nest consists of living chambers, passages and store rooms. Some nests are built underground, and others in trees.

A termite nest in a national park in South Africa.



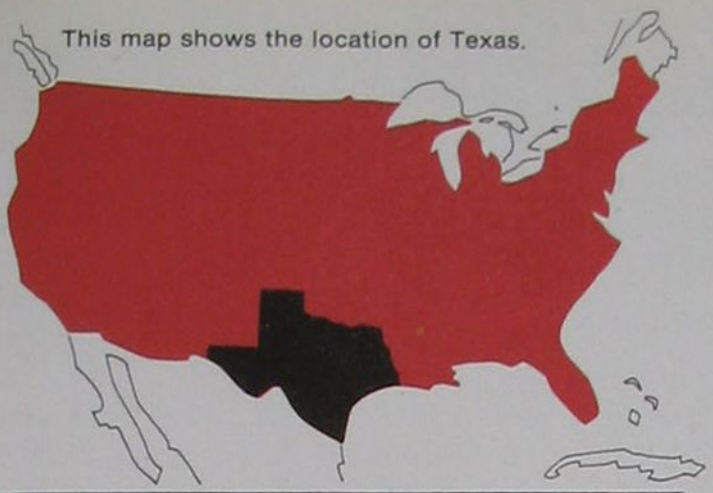
Inside the nest, a *king* and a *queen* termite head the colony. When the king and queen are young, they have wings and mate on a 'marriage flight'. They fly away from the colony in which they were hatched and start their own. The queen swells to a huge size and lays thousands of eggs every day. The king and queen are looked after by *worker* termites, who take the eggs away and care for them. The eggs hatch out into workers and *soldier* termites, and a few become new kings and queens. The workers and soldiers are blind and wingless, but they have a keen sense of smell. The workers build the nest and collect food, while the soldiers defend the nest.

Termites eat wood, and have been known to destroy whole wooden buildings in the tropics, where they live. They also do great damage to sugar cane and fruit trees.

Texas is the second largest state in the United States after Alaska. It shares a lengthy border with Mexico along the Rio Grande. Texas was an independent republic for nine years before it joined the U.S. in 1845.

Texas has a population of 11,197,000. Houston is the largest city and port. Other large cities include Dallas, San Antonio and Austin, the state capital.

Texas covers 267,339 square miles, much of which is fertile plain. There are also extensive pine forests. The state is important agriculturally. Its farms are the country's foremost producers of cotton



This map shows the location of Texas.

and sorghum, and its ranches rear more cattle and sheep than those of any other state. Underground lie some of the country's richest deposits of oil and natural gas. Oil drilling and refining, food-processing, and chemicals are the state's chief industries.

Texas was once one of the Spanish territories in America. In 1821, it became part of independent Mexico. American settlers who moved there revolted against Mexico in 1835. Soon afterwards Texas became a state. The Mexican War of 1846-1848 was fought to determine the Texas-Mexico border.

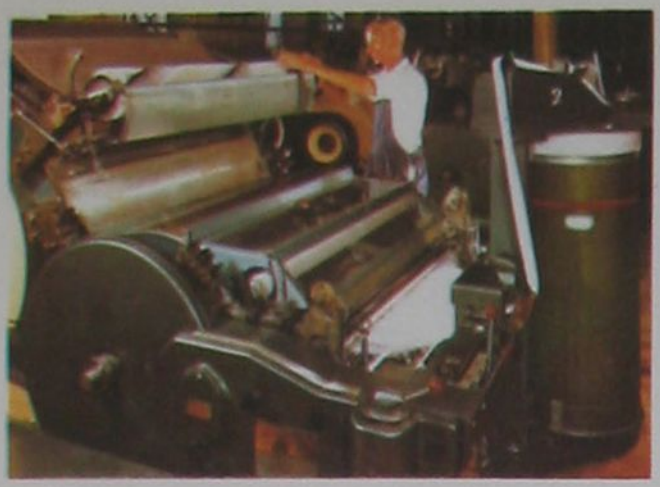
Textiles Most of our clothes, and the fabrics we use in the home for curtains, blankets, sheets and upholstery are made by weaving. Woven fabrics are called textiles, although the term is often applied to knitwear, lace, and other non-woven fabrics, too.

Woven fabrics are made by interlacing yarns of various kinds. The yarns are made up of thousands of short, fine fibres twisted tightly together. Drawing out and twisting the fibres into yarn is called *spinning*. The most common fibres used in textiles are cotton, wool (from sheep), flax, silk (from silkworms), and man-made fibres such as rayon and nylon. (See Fibres.)

Before the natural fibres can be spun, they must be clean. Raw cotton arrives at the spinning mill in tight bales. Machines open up the cotton into a fluffy mass, beat it to remove any dirt, and form it into a continuous *lap*, or sheet. The lap passes to a *carding machine*, which combs out the cotton fibres until they are more or less parallel. Then the fibres are gathered in loose slivers.

After combing, the slivers enter the

Texas was first explored and settled by Spaniards. They built a number of missions there, several of which, like this, are still standing.



Above: A carding machine combs the cotton fibres, gathering them together into sliver.

Left: A container of artificial fibre after the dyeing operation.

Below: A machine producing a continuous filament of viscose rayon for use as textile yarn.

drawing frames, which draw them out thinner and twist them. They emerge from the frames as *roving* in a form suitable for spinning. Flax fibres are combed and made into roving in a similar way.

Raw wool is greasy and dirty when it arrives at the spinning mill. It is cleaned by beating and by treatment with chemicals. Then it is carded and drawn into roving.

Silk needs little preparatory treatment because it is already in fine, continuous fibre form. Yarn is made simply by twisting the fibres together.

Cotton and wool are spun on the *ring-spinning frame* and the *spinning mule*. In both machines, pairs of rollers draw out the roving into finer and finer yarn. On the ring frame, the yarn is wound through metal clips called *travellers* onto rotating *bobbins*. The travellers move round the bobbins and twist the yarn. On the mule, the drawn yarn is twisted and wound on spindles moving backwards and forwards on a carriage.

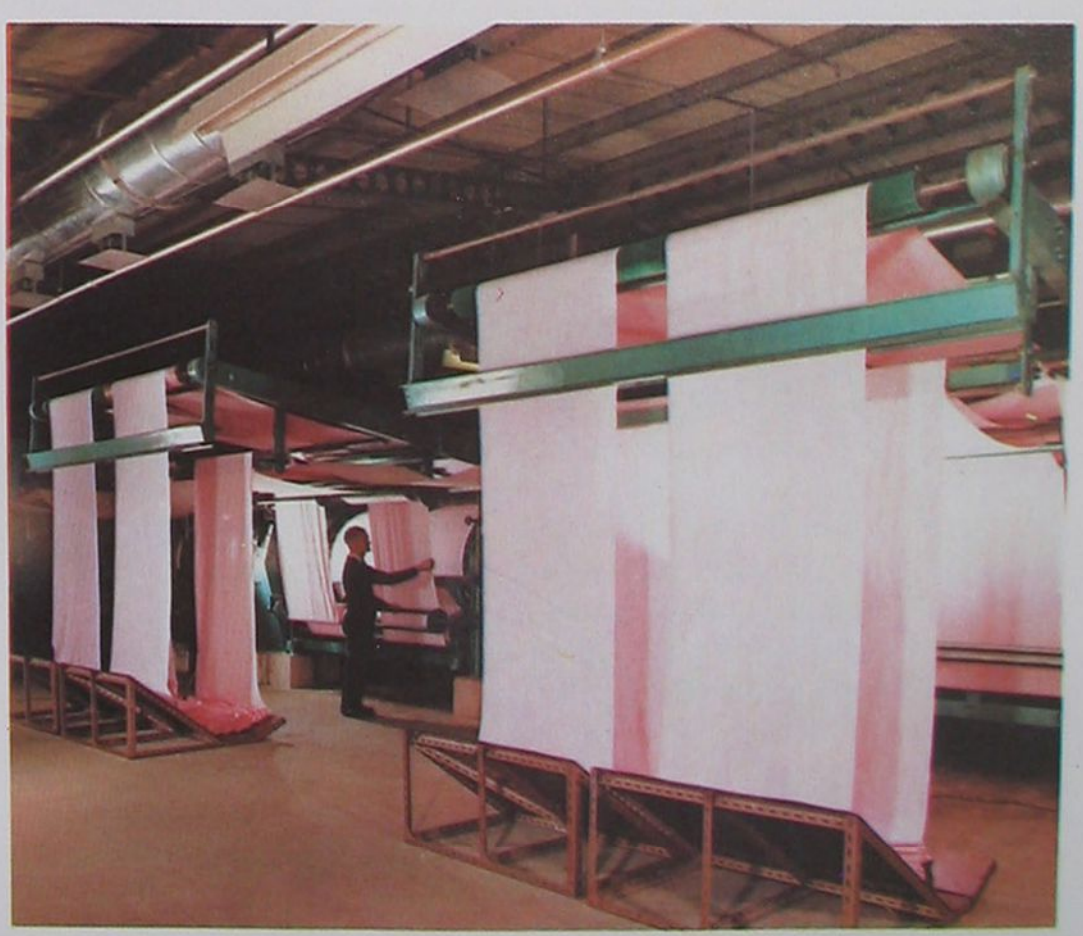
Wool may also be spun on variations of the ring-spinning machine called the *cap frame* and *flyer frame*. Flax yarn is always spun on a flyer frame.

Man-made fibres are produced in the form of long *filaments*, or threads. They may be used in this form for weaving, but they are usually chopped up into short, staple fibres for spinning in the usual way.

Weaving is basically very simple. One set of threads (the *weft*) is passed crosswise under and over another set of lengthwise threads (the *warp*). But it is far easier to raise and lower the warp threads and pass the weft threads between them. This is what happens on the weaving loom.

The warp threads are stretched out and alternate threads are raised or lowered by devices called *healds*. A *shuttle*, carrying the weft thread, shoots through the *shed*, or gap between the raised and lowered threads. Then a comb-like *reed* packs the weft thread tightly against the other weft threads. The healds reverse the warp threads, the shuttle shoots

Above: A framework containing bobbins of yarn for creeling, feeding the yarn into a carpet loom.



Right: An arrangement for passing the cloth over a series of raising machines. These machines raise the nap of the cloth to give it a slightly furry texture.

across, and the process is repeated.

To make intricate patterns, a Jacquard loom is used, in which each warp thread is controlled by a punched card.

The woven fabric must go through a number of finishing processes before it is ready for sale. Most fabrics are naturally drab. They may be made pure white by bleaching, or coloured by dyeing and printing. Dyeing can in fact be done at any stage between fibre and fabric.

In dyeing, the whole fabric generally has the same overall colour. But it can be given a mixture of colours if it is made up of a mixture of different fibres. In printing, the fabric is given a coloured design by roller printing or by printing through a silk screen.

Many fabrics are given special finishes —for example, to make them shrinkproof or creaseproof. A shrink-resistant finish is obtained by closing up the weft threads in the fabric. A crease-resistant finish is obtained by impregnating the fabric with a resin.

Above: Ceremonial boats at a boatyard in Bangkok, the capital of Thailand or Siam.

Right: Thai dancers wear a traditional Siamese costume. The ornate headdress is an unusual feature of this costume.

Thailand is a mainly agricultural kingdom in south-eastern Asia. It used to be called Siam. Thailand is a Buddhist country with many beautiful temples.

Burma, Laos and Cambodia border Thailand. In southern Thailand, the Isthmus of Kra stretches to Malaysia. Two important rivers, the Salween and Mekong, flow near Thailand's northern borders. Mountain ranges run north to south on the western border, but no peaks top 8,500 feet. The large, dry Khorat plateau covers north-eastern Thailand. Central Thailand is the main rice-growing area. The country has a wet tropical, monsoon climate. Thick forests cover large areas.

The Thai people migrated from southern China hundreds of years ago. Many other Chinese people moved to Thailand later. Most Thai boys become Buddhist monks for a few months as part of their education. Thailand's outstanding art includes the *Ramakian*—a dance-drama about prince Rama and his bride, Sita.

Rice is the chief food crop. The country exports rubber and timber. Tin and other minerals are also important. Fishing is a major industry. River transport is more important than the roads or railways.

A Siamese state flourished in the 1300's. Its capital was at Ayutthaya, north of present-day Bangkok (then a coastal swamp). The Siamese destroyed the power of the Cambodians in the east, but in the 1700's they were attacked and defeated by the Burmese in the west. Unlike other south-eastern Asian countries, Siam never fell under European rule.

Between 1941-1945, Siam expanded its borders with Japanese help. When Japan was defeated, Siam lost its gains. After 1945, it became an ally of the United States. Influenced by the war in neighbouring Vietnam, Thai rebels fought government forces in the late 1960's.

Facts and Figures
Area: 194,456 square miles.
Population: 39,202,000.
Capital: Bangkok.

Thames The Thames is a river of southern England, and flows west to east from the Cotswold Hills to the North Sea. It rises near Coates, in Gloucester, and flows 210 miles to its estuary at Shoeburyness and Sheerness.

The river is tidal from its estuary up as far as Teddington Lock, and this section of the Thames is administered by the Port of London Authority. The Thames Conservancy controls the upper reaches from Teddington to the Cotswolds.

The Pool of London is the centre of deep-sea shipping in Britain. It is a dock-land area surrounded by great storage warehouses and is the main centre for foreign trade. At Tilbury is another large system of docks.

The Thames is connected by a series of canals with industrial towns in the Midlands, but the canals are less important than formerly.

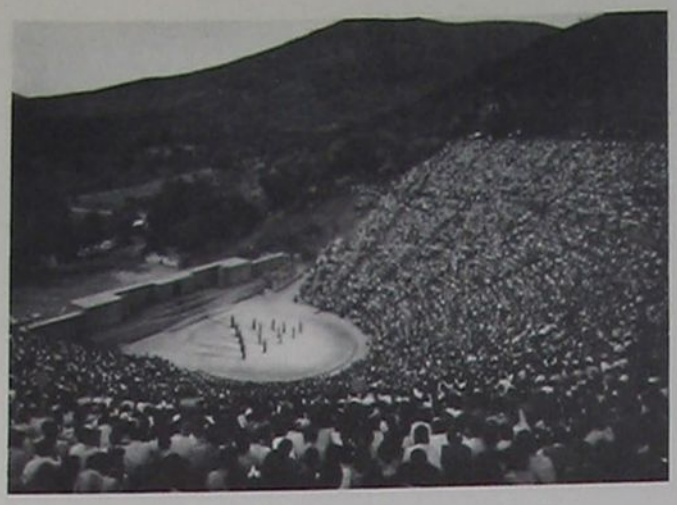
The Thames is important also as the main water supply of London. Water is taken from the river above Teddington and stored in great reservoirs. The river provides over two-thirds of the water supply for the London area.

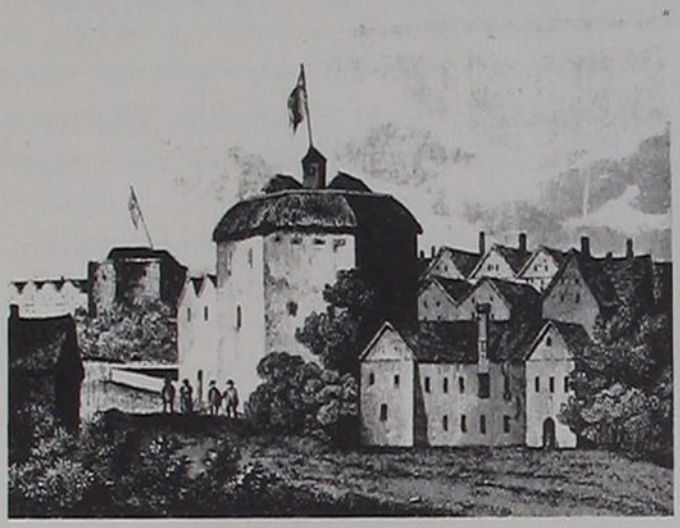
The Pool of London lies around Tower Bridge on the banks of the Thames.

Many factories and power stations empty their effluent into the Thames. The part of the river upstream from Teddington Lock has always been kept fairly clean because it is a source of water for the homes and factories of London. But the tidal part of the Thames has suffered

Right: The floating market is a famous part of Bangkok. People move from stall to stall in light boats, buying goods just as in any other market.

Location map of Thailand or Siam.





Two of the most famous theatres of the past: that at Epidaurus in Greece (top), built about 2,500 years ago, and the Globe Theatre, London, where some of Shakespeare's plays were given their first performance.

very serious pollution. In the early 1950's it was almost devoid of fish. Since then, great efforts have been made to improve the situation. In 1972, 63 species of fish were caught in the lower Thames.

Theatre A theatre is a place where plays are performed. The first theatres were in ancient Greece. Early Greek drama was performed in open-air theatres seating as many as 16,000 spectators. They sat in tiers (rows, one above the other) in a semicircle. Inside the semicircle was a flat area called the *orchestra*, where the chorus danced and sang. The actors, all men, wore masks, and entered from a wooden building called the *skene*. Later, a raised stage was probably added in front of this, but there was no curtain. The theatre at Delphi was so well designed that all 5,000 people in the audience could hear the actors clearly.

Roman theatres, though following Greek models with the audience still in a tiered semicircle, were more elaborate. Behind the stage was an imposing permanent background. In 99 B.C., stage scenery was first used.

We know little about the theatre from Roman until medieval times, when it was revived by the craft guilds. They performed *mystery* and *miracle* plays in the open, using movable carts and booths round the market place. Travelling actors would often perform on a simple stage in the courtyard of an inn.

The building of permanent indoor playhouses did not begin until the middle of the 1500's. In Italy they started building classical theatres, very like the old Roman theatres. One of the finest was the Teatro Olimpico at Vicenza. The first English playhouse was built by James Burbage in 1576 and called simply The Theatre. Burbage's sons built the Globe Theatre, where some of Shakespeare's plays were first performed. These Elizabethan theatres were very much influenced by the form of the inn yard, with the audience sitting or standing on three sides of the stage. There were small changing rooms behind the stage, and a small gallery above it.

During the 1600's and 1700's, the stage grew back from the audience, and movable scenery—painted panels moving in grooves or on wheels—was widely used. Footlights were introduced and the

Sir Henry Irving, painted by J. B. Lepage. Irving was a great figure in the British theatre, which he dominated for the last thirty years of the 1800's, both as an actor and manager.

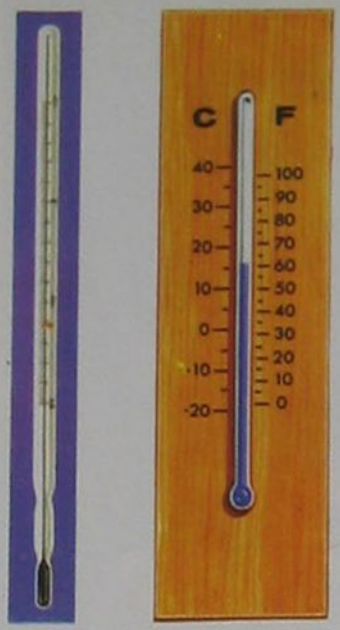
Right: A production of *Julius Caesar* by Shakespeare at the Festival held in 1965 at Stratford, Ontario, in Canada.

proscenium arch (the frame of the stage) was covered by a curtain. In the 1800's gas lighting and the *limelight* were introduced, and it was possible to darken the rest of the theatre, thus focusing attention on the stage. Scenery was becoming more realistic. Stage settings like real rooms were built, to fit the more informal methods of acting. Theatrical companies were controlled by directors rather than the actor-manager as before. Most theatres now follow the pattern of the late 1600's theatre, with a 'picture frame' stage. But the latest experiments have been with open staging and *theatre-in-the-round,* where the audience surrounds the acting area.

The longest continuously running play at one theatre in the United Kingdom is The Mousetrap, *by the famous detective-story writer Dame Agatha Christie. It opened at the Ambassadors Theatre, London, in November 1952 and was still running in 1973. One night was missed because of a power failure!*

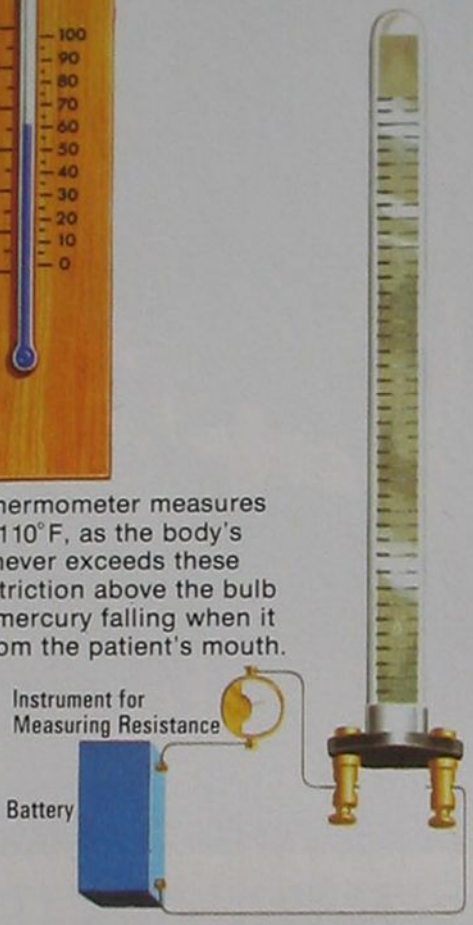
Thermometers are instruments that measure the hotness or temperature of an object. Temperature is measured in degrees. Every change brought about by heating can be used to measure temperature. An obvious change is the *expansion* or increase in size, which most objects undergo when they get hotter. (See Heat.)

The *mercury thermometer* makes use of expansion. It consists of a fine glass tube connected to a bulb containing mercury. As the temperature rises, the mercury expands and rises along the tube. The position of the mercury against a scale of degrees marked on the glass tube indicates the temperature. Doctors use a *clinical thermometer,* which is a special mercury thermometer. The tube is kinked just above the bulb, so that the mercury does not fall immediately the thermometer is removed from a patient's mouth. Some thermometers contain alcohol, which is generally dyed red or blue to make it easier to see.



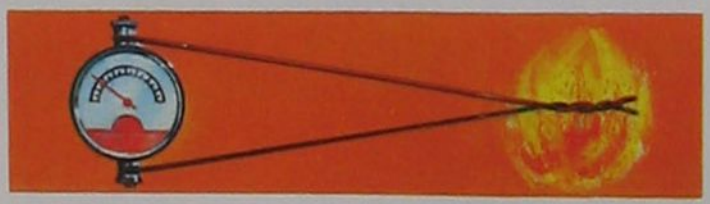
A domestic thermometer is usually graduated in degrees Centigrade and Fahrenheit.

The clinical thermometer measures from 95°F to 110°F, as the body's temperature never exceeds these limits. A constriction above the bulb prevents the mercury falling when it is removed from the patient's mouth.



The platinum resistance thermometer consists of a length of fine platinum wire wound on a mica frame and enclosed in a protecting glass tube. Temperatures are found by measuring the wire's electrical resistance, which increases as the temperature rises.

The thermocouple consists of two wires of different metals joined together at one end and connected to a meter at the other. If the first end is heated, a current flows and registers on the meter, indicating the temperature of the other junction.



Alcohol is used with mercury in the *maximum and minimum thermometer*. This U-shaped thermometer contains two metal markers, which mark the highest and lowest temperatures recorded.

One kind of electrical thermometer uses the principle of the *thermocouple*, a device that generates electricity when it is heated. Temperatures are indicated by the voltage generated. Another electrical thermometer, the *platinum resistance thermometer*, indicates temperatures in terms of the resistance of a piece of platinum wire. The *optical pyrometer*, for high temperatures, makes use of a material that changes colour as it becomes hotter.

Thermostat This is an automatic device that controls temperature. The temperature of many things in the home, such as electric irons, cookers and radiators, may be controlled by thermostats.

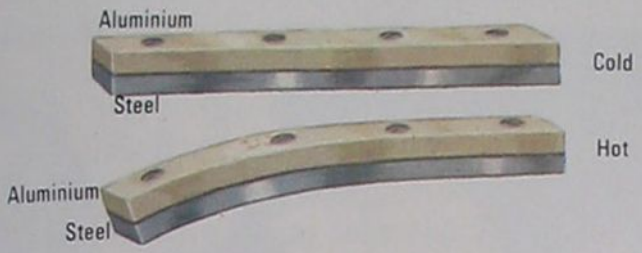
When an electric iron is used a certain temperature is selected. The iron is switched on and reaches the required temperature. When it becomes too hot, a thermostat switches off the electricity and the iron begins to cool. But before it can get too cool, the thermostat switches the current on again. In this way, a fairly constant temperature is maintained.

A typical thermostat is made of two different metals joined together to form a strip. One metal expands more than the other when heated. As the temperature rises, the metal that expands more lengthens and pushes the strip into a curve. The curve moves away from an electric contact, so switching off the supply of electricity. As the metal cools the strip straightens and touches the contact, and the current is switched on again.

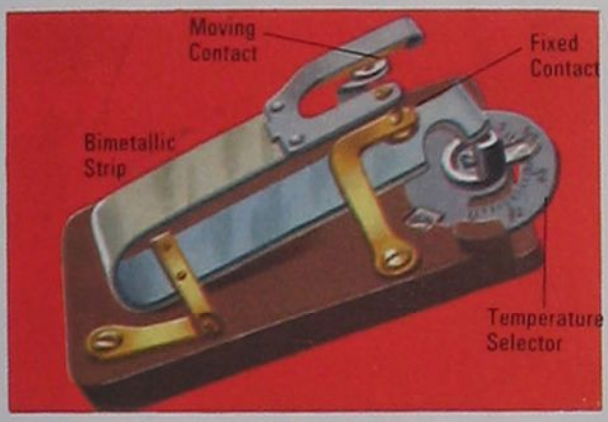
Other thermostats use the expansion of a liquid to switch electrical contacts, or the expansion of a metal rod to work a valve controlling the flow of gas or water.

Thunderstorms All thunderstorms form in similar conditions—when large pockets of moist air rise through cooler air. They usually develop in summer, when a mass of warm, humid air lies above the heated ground. The heated air rises, at the same time expanding and cooling. For the formation of a thundercloud, the surrounding air must be cooler than the rising column of air. As the rising air cools, its vapour condenses into millions of tiny droplets to form at first a white, fluffy cloud and eventually a black, menacing

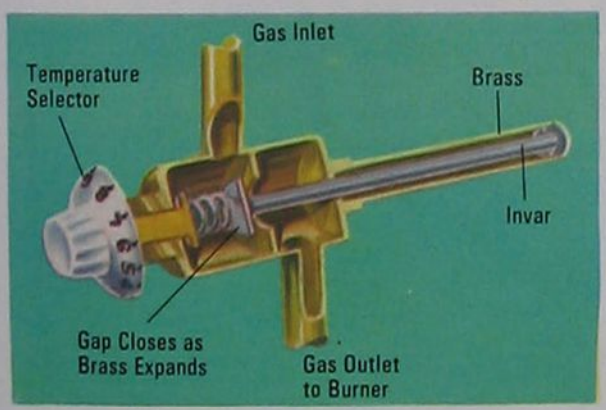
A thermostat in an electric iron. The control knob alters the distance through which the bimetallic strip must bend in order to break the circuit.



A Bimetallic Strip. One metal expands more than the other and causes the strip to bend when it is heated.



A central heating regulator contains a bimetallic strip to which an electrical contact is fixed.



A gas-oven thermostat contains a brass tube that expands more than a strip of invar alloy placed inside it, when the oven is in operation. This may cause the gap in a valve to close, cutting down the gas supply and cooling the oven.

thundercloud, or *cumulonimbus*. The water droplets turn to ice crystals, which grow until they are big enough to fall. As they fall they melt into raindrops, which are met by the upward current of air. Only the largest raindrops are heavy enough to force their way through the violent upflow of air travelling at speeds of 20 to 60 miles an hour. As a result, the rain in thunderstorms always falls in large drops.

The thunder and lightning produced in a thunderstorm are caused by electrical discharges between clouds or between a cloud and the ground (see Lightning). You can estimate how far away a thunderstorm is by counting the seconds between the flash and the thunder—every five seconds represents a mile.

Thunderstorms occur in almost every part of the world. They are most common in the tropics (Java, 225 days per year: central Africa, 150 days) and over land with a mild summer climate. A typical thunderstorm is from three to five miles across, but clusters of thunderstorms called *squall lines* may stretch for several

Lightning strikes between electric charges formed among thunder clouds or between the clouds and the ground.

hundred miles. At any one time there may be as many as 2,000 thunderstorms in progress throughout the world.

Tibet, a remote, high plateau in central Asia, is a Chinese territory. It covers nearly half a million square miles and has less than two million people. Its capital is Lhasa.

Several great rivers rise in the mountains of Tibet or in the neighbouring Chinese province of Tsinghai, including the Brahmaputra, Hwang Ho, Indus, Mekong, Salween and Yangtze.

Tibet has a low rainfall, but gale force winds bring snow blizzards. The exposed high ground is icy cold in winter but moderate in summer. Most of Tibet is unsuitable for farming.

Most Tibetans live in the sheltered valleys of the south, farming the better land. A few roam the bleak and desolate plateau, grazing animals, especially yaks. These animals provide not only food, but

Above: Location map of Tibet.

Right: An old Tibetan woman holds a small prayer mill. She is one of many refugees who have fled from Chinese rule in Tibet to live in Sikkim, a small country between Tibet and India.

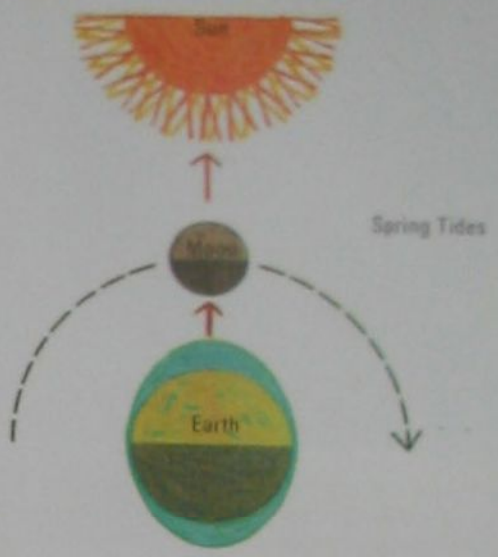
also transport and the material for clothing and tents.

Before the mid-1950's, Tibet followed a unique way of life that had changed little in hundreds of years. Most men had one wife, but wealthy men took several wives. Several poor brothers sometimes married the same woman. Tibet was governed by feudal nobles and by the chief *lamas*, or monks, of the Lamaist religion. Tibetan Lamaism, headed by the Dalai Lama, is a combination of Buddhism with age-old cults.

Tibet's traditional way of life was swept away when the Chinese government re-established Chinese rule in Tibet in the 1950's. In 1959, many Tibetans fled to India. Among them was the Dalai Lama. In the 1960's, Chinese rulers reorganized Tibet.

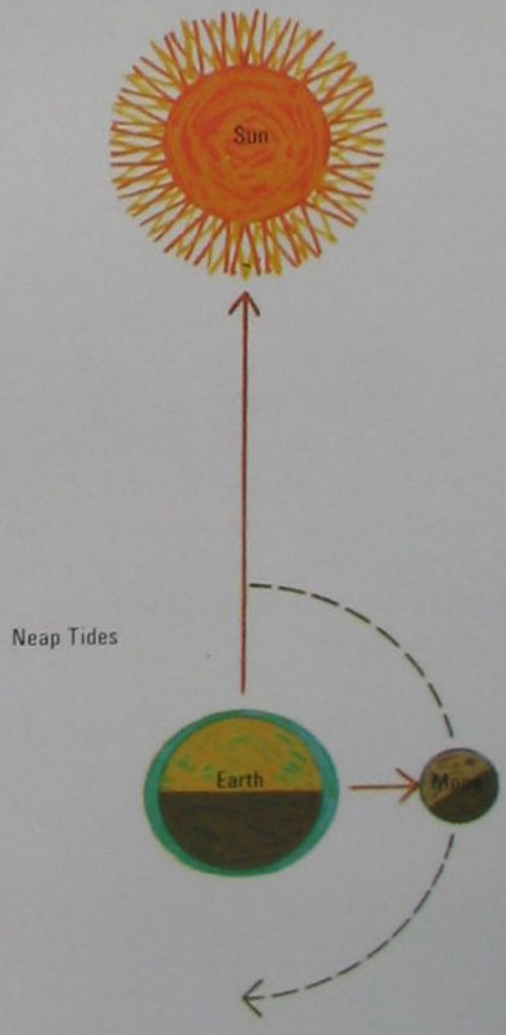
Tides are the regular rise and fall that occur in sea-level twice a day. Tides are caused by the forces of gravity exerted on the Earth by the Sun and Moon. These bodies tend to pull the water in the oceans up towards themselves. As the Earth rotates, the rise in level moves around the world, following the Moon. Another rise in level occurs on the other side of the Earth, opposite to that beneath the Moon. This rise balances the first rise. When these rises in level meet the shore, a *high* tide occurs. Midway between the two, the level falls to *low* tide. As the Moon itself moves once around the Earth every 29½ days, the tides do not arrive twice every 24 hours, but twice every 24 hours 50 minutes.

The Sun also has an effect on the tides, but this effect is much smaller than that of the Moon, because the Sun is so far away from the Earth. The rise and fall are greater when the Sun, Moon and Earth are in line. This occurs twice a month, at Full Moon and New Moon, and these tides are called *spring* tides. But when the Moon and Sun form a right-angle with the Earth, they pull against each other, and the rise and fall of the tide is small.



Above: Spring tides occur when the Sun and the Moon form a straight line with the Earth. The two bodies act together to lift the water in the oceans, giving the extra-high tides.

Below: Neap tides occur when the Sun and the Moon are at right-angles to each other. Their forces of gravity act against each other so that the tide rises to a minimum level.



By placing a barrage across river estuaries, the rise and fall of tides can be used to generate electricity as in this French power station on the Rance.

These tides are the *neap* tides. The highest spring tides occur at the spring and autumn *equinoxes*, at the end of March and September, when the Sun is above the Equator.

The rise and fall of the tide is only a foot or two in mid-ocean, but when it nears the shore it increases. On the Atlantic coast, the tide rises and falls between 10 and 20 feet. But in the Mediterranean Sea, which is too small to respond to the Sun and Moon and is almost cut off from the Atlantic Ocean at the Strait of Gibraltar, the rise and fall is only a few inches.

Men are beginning to harness the power of the tides by building barriers across river estuaries with great tides. As the tide rises and falls, the water flows through sluice gates in the barrier and powers turbines that generate electricity.

The geography of the sea-bed and shore causes varied tides in a few places—some may have only one high tide a day whereas others have four.

Tiger This is a fierce forest animal of Asia. It is among the biggest and most powerful members of the cat family. In fact, there

The tiger's yellowish and dark-striped coat is said to make it almost invisible among bamboos. In some regions, where snow falls in winter, the yellow may be creamy white. Almost black tigers have been found in Malaysia.

Opposite: A Bengal tigress carries one of her young cubs in her mouth. At birth the cubs weigh about three pounds and are helpless.

are tigers in Siberia, in northern Asia, that reach 13 feet in length and 650 pounds in weight—the biggest of all 'big cats'. But most tigers are about the same size as lions—about 9 feet from the nose to the tip of the tail and weighing 450 pounds.

Lions and tigers are very similar internally, but their external appearance differs greatly. Tigers do not have the thick mane of the male lion. They have smooth, glossy fur, thicker than a lion's body hair. Tigers are light brown in colour with many irregular dark stripes.

Unlike lions, tigers live alone. They generally sleep by day and hunt at night. They attack and eat almost any but the biggest animals, and their main food is antelope and wild cattle. They rarely attack man unless frightened or very hungry. The female tiger gives birth to two to four cubs. They live with her for two years before leaving to hunt for themselves.

Timber industry Every year thousands upon thousands of trees are felled in the vast forests of the world to provide us with timber, one of our most important raw materials.

The felled trees are transported from the forests to the sawmill. There the tree-trunks are sawn into posts and boards or cut into small logs for the mills which make wood-pulp for paper making. This process of felling and transporting timber is often called lumbering. The people who cut down the trees are sometimes called fellers, or lumberjacks.

Trees are cut down for timber in most parts of the world, but most of the world's timber comes from the huge softwood forests of North America, northern Russia, and Scandinavia. These softwood forests consist mainly of conifers, or cone-bearing trees, such as pine, spruce,

western red cedar, and Douglas fir. They are evergreens which thrive in a cold climate.

Hardwood forests are found in warmer regions, such as central Europe and the eastern United States. Important hardwoods include beech, birch, chestnut, red gum, maple, elm and oak. Sometimes hardwoods and softwoods grow together in mixed stands.

Valuable timber trees which grow in the tropical rain forests near the Equator include balsa, teak, and mahogany.

In the vast softwood forests of the north, lumbering is becoming increasingly mechanized. The power saw is replacing the hand axe for felling. The tractor is replacing the horse for hauling the logs.

Before the fellers move into the forest, a forester marks the trees which have to be cut down. To cut down a tree, a feller first makes a wedge-shaped undercut in the trunk close to the ground on the side where he wants the tree to fall. Then he slices through the trunk with a powerful chain saw. The tree loses its balance because of the undercut and crashes to the ground.

Above: Hauling a Karri log through the woods with a tractor and logging arch in Western Australia.
Below: Loading up sawn lengths of tree trunks in Maine, in the north of the U.S.A.

The tree-trunks, which may be 200 feet long, are sawn into shorter lengths so that they can be moved more easily. They are dragged by tractor, cable, or sledge to a central point in the forest to await transport to the saw-mill.

The logs may be carried to the saw-mill by trucks, or they may be made into a raft and floated down nearby rivers or across lakes. Sometimes thousands of logs are towed by tug, in a floating enclosure called a boom.

At the saw-mill, the logs are stored in a log pond, or millpond, until they are needed. Logs for the wood-pulping plant are cut into shorter lengths. Logs for board-making enter the sawmill through jets of water, which remove dirt and grit from them. Then they may be debarked before they reach the first saw, which slices them into boards.

One type of saw works in much the same way as a bacon slicer. A carriage holds the log and moves it backwards and forwards against the saw blade. Another type of saw, called a *gang saw*, has a number of blades which slice through the log in one operation.

The boards then pass through other sets of saws which trim the sides, square up the ends, and cut them to the required size.

But the timber is not yet ready for sale. First it must be *seasoned*—its excess moisture must be removed. Timber will warp badly if it is used unseasoned. Seasoning is done by stacking the timber in the air or in heated kilns to dry. The timber may also be planed (smoothed) before it is sent to the timber yards. But quite a lot of unplaned rough timber is used in the construction industry for

Right: Transporting the logs by river. Here, lumberjacks are working to free a jam, using long poles.

making such things as joists and frames.

In some mills, the logs are sliced into thin sheets, or *veneers*. Veneers of ordinary wood are glued together, with their grains at right angles, to make plywood. Veneers of expensive woods, such as mahogany, are used widely in furniture-making to provide a richer surface finish for cheaper woods.

Talking points

* Discuss the importance of timber in the modern world. What functions that used to be performed by timber are now filled by synthetic materials?
* Trace a map of the world from an atlas. Mark in the principal timber growing areas and the types of tree that grow there. Show the routes by which timber is transported throughout the world, and the uses to which it is put.
* Discuss the differences between the methods used to fell and extract trees one hundred years ago and the methods used today.

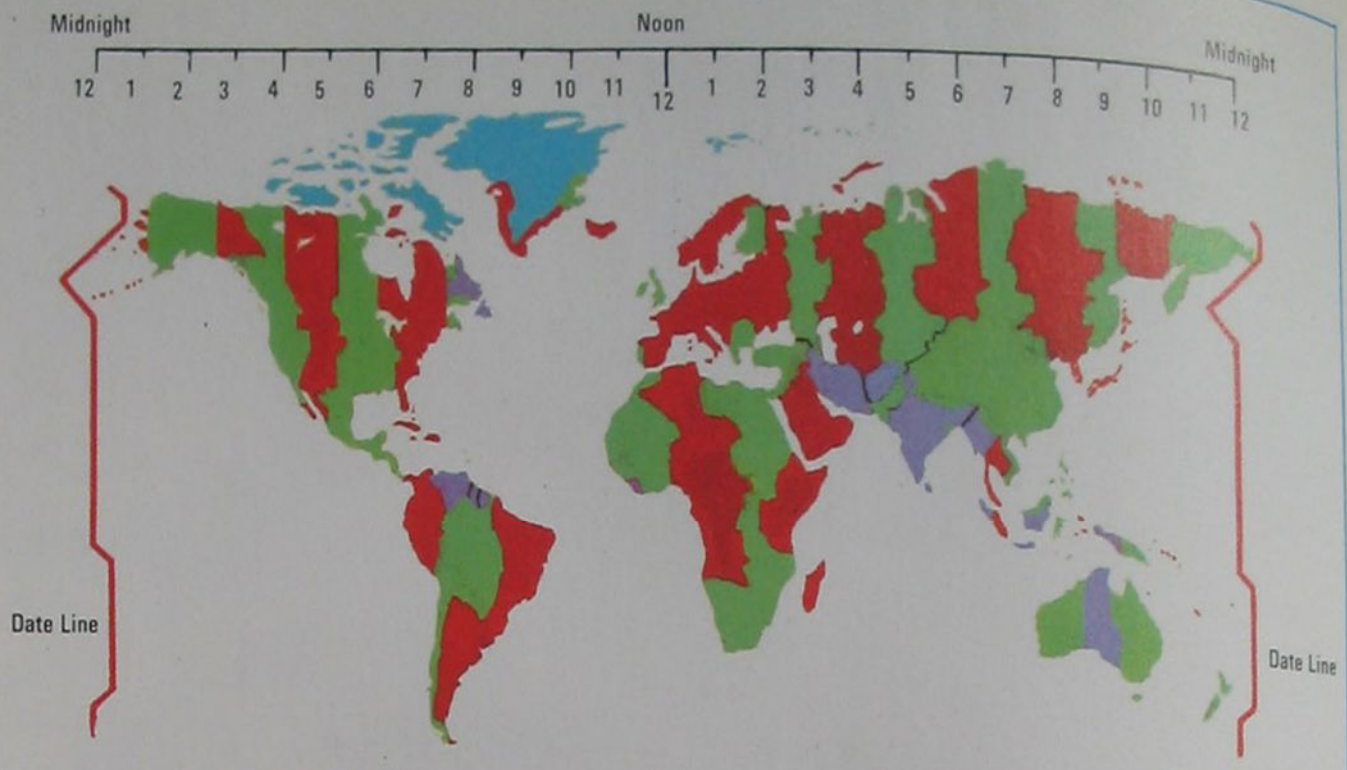
Articles to read

Conifers; Deciduous trees; Forestry; Trees.

Timber-line is the line on a mountainside above which trees cannot survive. Above this point the weather is too cold for anything but the hardiest shrubs. Often the ground remains frozen for much of the year. Even mountains in tropical regions have a timber-line. But it is at a higher altitude than in temperate regions. The sunny side of a mountain has a higher timber-line than the shady side, because it is warmer.

Time Man probably first measured time in days by observing the passage of the Sun across the sky. Then he observed the phases of the Moon and the change in seasons, and constructed a calendar (see Calendar). With the invention of accurate clocks in the Middle Ages, he was able to divide the day into 24 hours, and the hours into minutes and seconds.

So that the hours of day and night fall at approximately the same times on the clock, there are many different time zones around the world. Most time zones are one hour apart, although a few are half-an-hour apart. In small countries, the same time is kept throughout the country. But in large countries, such as the United



The Earth is shown divided into time zones. The blue areas have half-hourly differences from Greenwich Mean Time. When you are travelling from west to east, the hour goes forward at each zone, but back by 24 hours at the International Date Line.

States, there are several time zones.

When you travel from west to east, you have to advance the hour hand of your watch every time you enter a new time zone. But if you cross the International Date Line in this direction, the clock time goes back by 24 hours to make up the time difference. The Line follows the 180° meridian except where it crosses land.

Tin The most familiar use of this metal is in making tinplate for tin cans. Tinplate is thin steel sheet which has been coated with tin by dipping in molten metal or by electroplating. The tin protects the steel from corrosion but does not taint foodstuffs in the cans. It is not used by itself for cans because it is too soft and bends too easily.

Tin is also widely used in alloys, including bronze (with copper), pewter, and solder (both with lead). With antimony and copper, it is used in bearings.

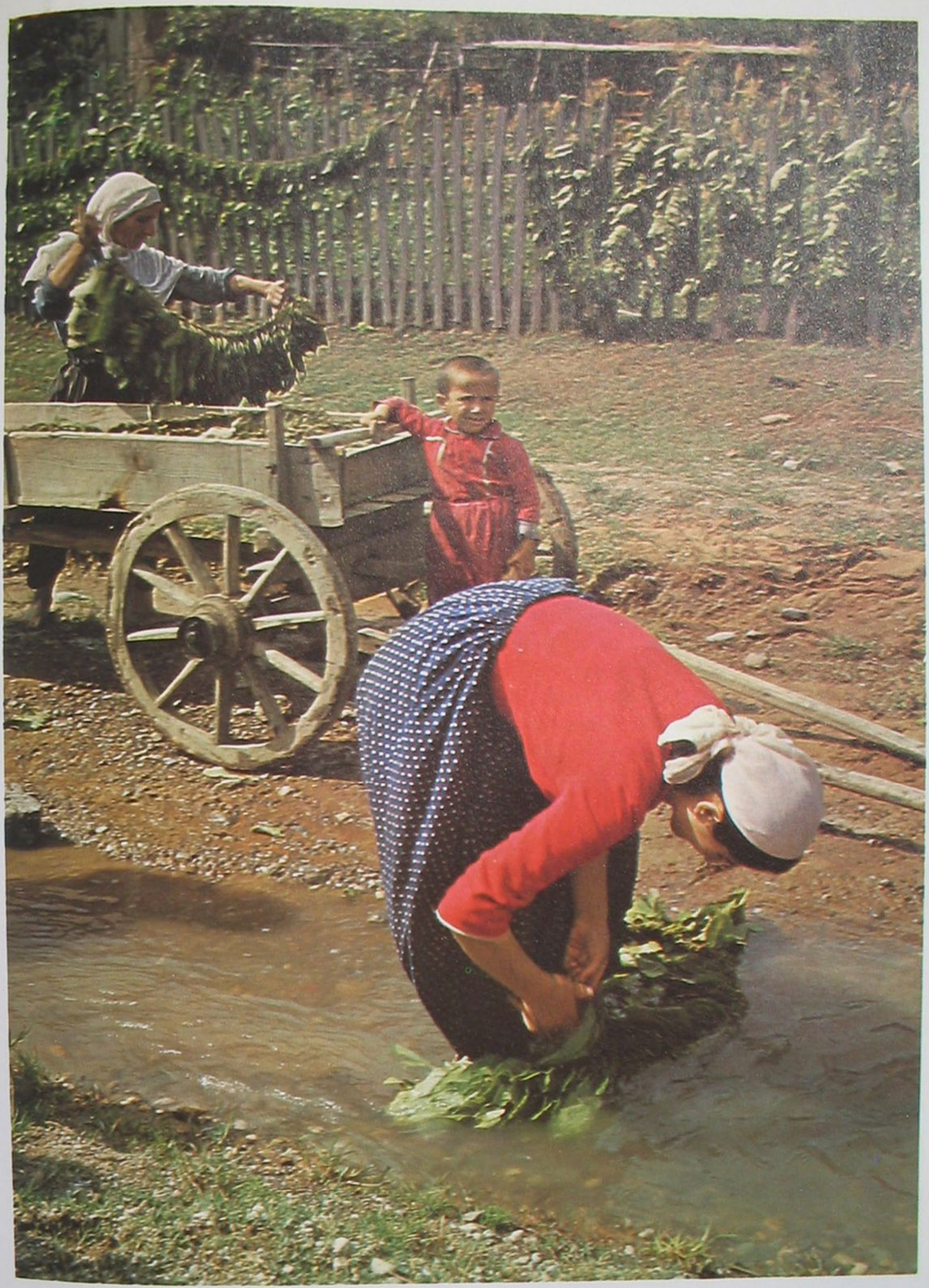
The ordinary form of tin is known as white tin. But at low temperatures, grey specks of another form called grey tin begin to appear and spread over the surface. This is called *tin plague*.

Tin is obtained from cassiterite, much of which is found in stream gravels.

Titanium, a chemical element, is a metal. It is stronger than steel, yet far lighter in weight. Titanium can withstand high temperatures and it does not rust in water or air. It is often alloyed (combined) with other metals. It is used to make surgical instruments, and parts for ships and jet aeroplanes. Titanium ores are abundant as minerals, but the pure metal is still costly to extract.

Tobacco is the plant from which cigarettes, cigars, pipe tobacco and snuff are made. Tobacco leaves contain a poisonous substance called *nicotine* that causes a slight increase in blood pressure during smoking

Opposite: A Turkish woman washes carefully strung tobacco leaves before they are hung up to dry.



Tobacco harvesting in New Zealand.

of the cured leaves or inhaling of snuff (powdered tobacco). This may produce a temporary feeling of relief from strain, but it causes people to become addicted to tobacco smoking.

Some useful drugs can be made from tobacco plants, but the smoking of tobacco is harmful in that smokers have a greater risk of developing lung cancer and other serious illnesses than non-smokers.

Tobacco came originally from South and Central America, but it grows well in many warm regions with plenty of sunshine and rain, and good soil. The world's leading tobacco-growing countries are the United States, China, India and Brazil. Cuba and Jamaica are famous for their high-quality cigar tobacco.

The leaves of the tobacco plant are harvested in the autumn, and sent to the curing house. In the curing house, the leaves are dried over fire or in kilns. This process turns them the yellow-brown colour of smokers' tobacco. The method of curing imparts certain flavours to the tobacco. In another curing method, the leaves are left to dry in the sun. Cigar tobacco is cured in this way.

Talking points

* The connection between tobacco smoking and cancer has now been established beyond doubt. Why do you think that no governments have so far put a complete ban on smoking?
* Many people who smoke heavily would like to be able to give the habit up, but feel that it would be too difficult. Can you think of any ways in which they could be helped to break the habit?
* Work out the cost of smoking twenty cigarettes per day for a whole year.

Articles to read

Lung; Raleigh.

After curing, the tobacco is stored for at least a year before being made into cigarettes, cigars, pipe tobacco, or snuff. Various kinds of tobaccos may be blended together to produce different flavours. Cigarettes contain Virginia or Oriental tobacco, which has a slight perfume. Flavourings and spices are added to pipe tobacco and snuff.

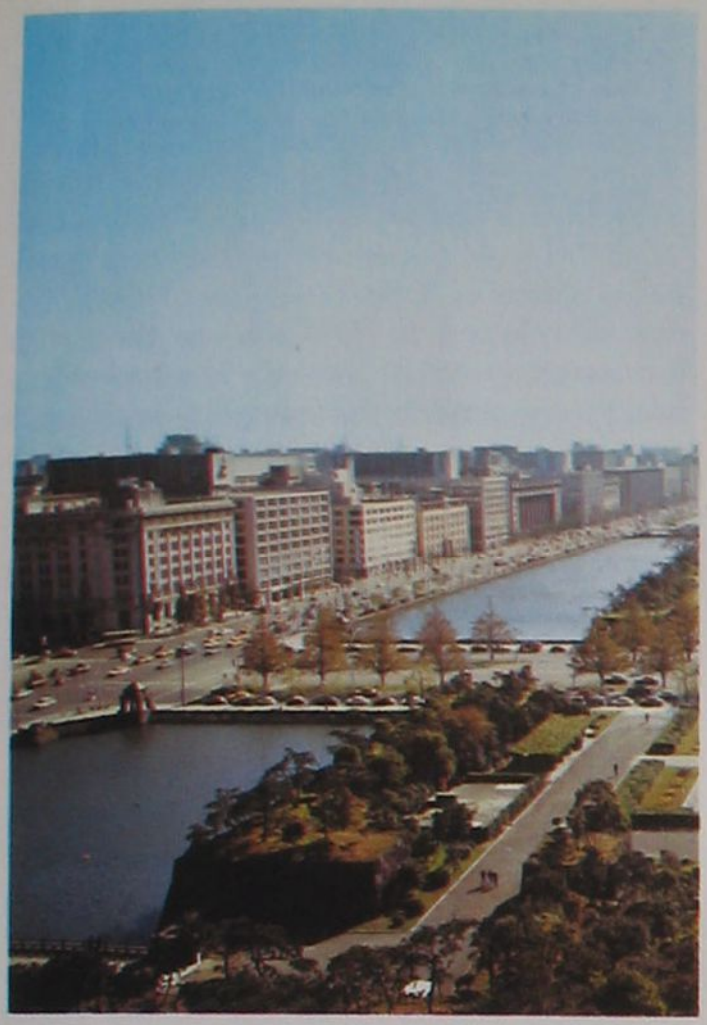
This map shows the location of Togo.

Togo is a small West African republic. It borders on Upper Volta, Dahomey and Ghana. It has a short coastline on the Gulf of Guinea. Lomé, the capital and only large city, is a seaport. Togo has an area of 21,853 square miles. A chain of mountains cuts diagonally through the country. Elsewhere there are sandy plains and grasslands and coastal swamps.

Togo's 1,955,000 inhabitants belong to a number of Negro tribes. French is the official language, but tribal languages are commonly spoken. Most of the people are farmers. They grow their own food and a few export crops such as coffee, cocoa, palm nuts and cotton. Phosphate minerals are a major export. There is also some fishing. Togo was a French colony until it became independent in 1960.

Tokyo (pop. 11,404,000) is the capital of Japan and the largest city in the world. Its metropolitan government is responsible for an area of nearly 800 square miles.

The city is situated on the island of Honshu, the mainland of Japan. It occupies both banks of the Sumida River,



Above: Tokyo, the Asakusa Gate.
Left: Modern Tokyo is centred on the grounds of the old Imperial Palace, which was almost completely destroyed in World War II.
Right: Although traditional architecture survives, the old buildings are being rapidly replaced by modern blocks of flats and offices.

which flows into Tokyo Bay. At the mouth of the river is a man-made harbour with wharves for small coastal freighters. The city's main seaport is at Yokohama.

Tokyo is the chief commercial and industrial city as well as the political and economic centre of Japan. It is the seat of government and the Imperial residence. The Imperial Palace occupies the site of the old Edo Palace, the seat of the former Shogunate government until its overthrow in 1867.

The city is a great centre of culture, and a unique blend of East and West. Tokyo University (1869) is the oldest university in Japan. There are theatres where the highly stylised ancient 14th century *nō* plays may be seen.

Tolstoy, Count Leo Nikolaevich

1910), was one of the most powerful Russian writers. He is mainly remembered for his two great novels *War and Peace* and *Anna Karenina*.

Tolstoy was born into a noble family at their estate of Yasnaya Polyana. Both his parents died during his childhood and he was brought up by relatives. From 1844 to 1847 he studied oriental languages and law at the University of Kazan, but did not take a degree. He returned to his estate for a short while, but in 1851 joined the Russian army in the Caucasus, where he began to write. In 1852 his first story, *Childhood,* met with considerable success. *Boyhood* (1854) and *Youth* (1857) followed. He took part in the defence of Sevastopol in the Crimean War, and based *The Sevastopol Stories* on the fighting he witnessed there.

In 1856 he went to St. Petersburg, where he was extremely popular. He then

Tolstoy's great novel War and Peace, *published in serial form in the 1860's, is set during the Napoleonic Wars and deals with the lives of the Russian aristocracy and the overwhelming changes made by the French invasion of Russia.*

travelled in Europe, studying educational methods, which he later adapted in his school for peasant children at Yasnaya. He married Sophie Behrs in 1862, and there followed 15 very happy years on his estate. It was during this period that he wrote his two masterpieces, *War and Peace* and *Anna Karenina.*

He began to think deeply about the meaning of life, and changed from his former happy outlook to a strictly moralist one, trying to achieve self-perfection. *A Confession,* published in 1882, tells us much of this inner crisis. He also wrote many religious and moral pamphlets. In 1890 he renounced all his property.

In 1901, because of his ideas and teaching, he was excommunicated by the Russian Orthodox Church, though he retained a wide and very admiring following. He died in 1910, tormented by his failure to live up to his high ideals.

Tools were first used by Man in prehistoric times, a million or more years ago, and this ability was one important factor that set him apart from other animals. During the Stone Age, Man used rocks as simple hammers. Later, he fashioned axe heads, scrapers, knives and other sharp tools by chipping and shaping stone. He also made bone and ivory tools for piercing, and used a simple drill consisting of a pointed shaft turning in a bow string.

Beginning about 4000 B.C., Bronze Age men learned to make tools out of metals, such as copper, tin, and bronze, which they mined, smelted and cast. These tools could be designed more efficiently than the old stone ones and were more reliable in use. By 1300 B.C., crude steel was being used, and by the time of Christ, most of the basic hand tools were known.

An early form of woodworking *lathe,* turned by a rope attached to a springy log, was used in medieval times, but the first real machine tools came in the late 18th century. A water-powered boring machine was invented in 1775, and the first *hydraulic* (fluid pressure) press was developed in 1796. Since then, the increased speed of modern machine tools has necessitated the development and use of alloys of tungsten and other metals.

When you look at small objects made of several metal parts, you will realize that tools for metal-working must be able to work to a very high degree of accuracy. Particularly important are measuring tools, and many micrometers and calipers can measure such minute distances as one ten-thousandth of an inch.

Tornado is a small but intense storm, rarely more than 200 yards across, with winds whirling at over 300 miles an hour around a centre of very low pressure. For its size, the tornado is the most destructive of storms. Its twisted black *funnel* steers a zigzag path of destruction across the land. A tornado has been known to destroy every building on one side of a street yet leave those on the other side untouched. Much of the damage caused by a tornado is due to the rapid fall in pressure, which causes buildings to explode outwards.

There is still a lot to be learnt about the origin of tornadoes. They form in unstable air conditions, with sharp differences in temperature at different levels. Sinking cold air and rising warm air create violent whirlwinds, thunder and lightning, heavy rain, and the characteristic 'hissing' sound of the dark cloud whirling into a black funnel. The 'hissing' becomes a 'roar' when the funnel reaches the ground and stirs up the dust. Over the sea, a tornado can cause a *water-spout.*

Toronto is the second largest city in Canada after Montreal. It has 2,366,000 people in its metropolitan area. The city is situated in south-eastern Ontario, on the north shore of Lake Ontario. It is Ontario's provincial capital.

Toronto is a busy port, and a manufacturing and industrial centre. It is also important in finance and commerce. Its

factories produce machinery, chemicals, clothing, processed foods and a variety of other goods.

Toronto has a well-known university, many libraries, schools, museums and parks. The city has an opera company, a symphony orchestra and many theatres. An airport, railways and fine roads serve its transport needs. It has several radio and television stations. Each summer the Canadian National Exhibition attracts visitors.

French fur traders established Fort Toronto as a trading post in 1749. The British later changed its name to York. The name was changed back in 1834, when the city charter was granted.

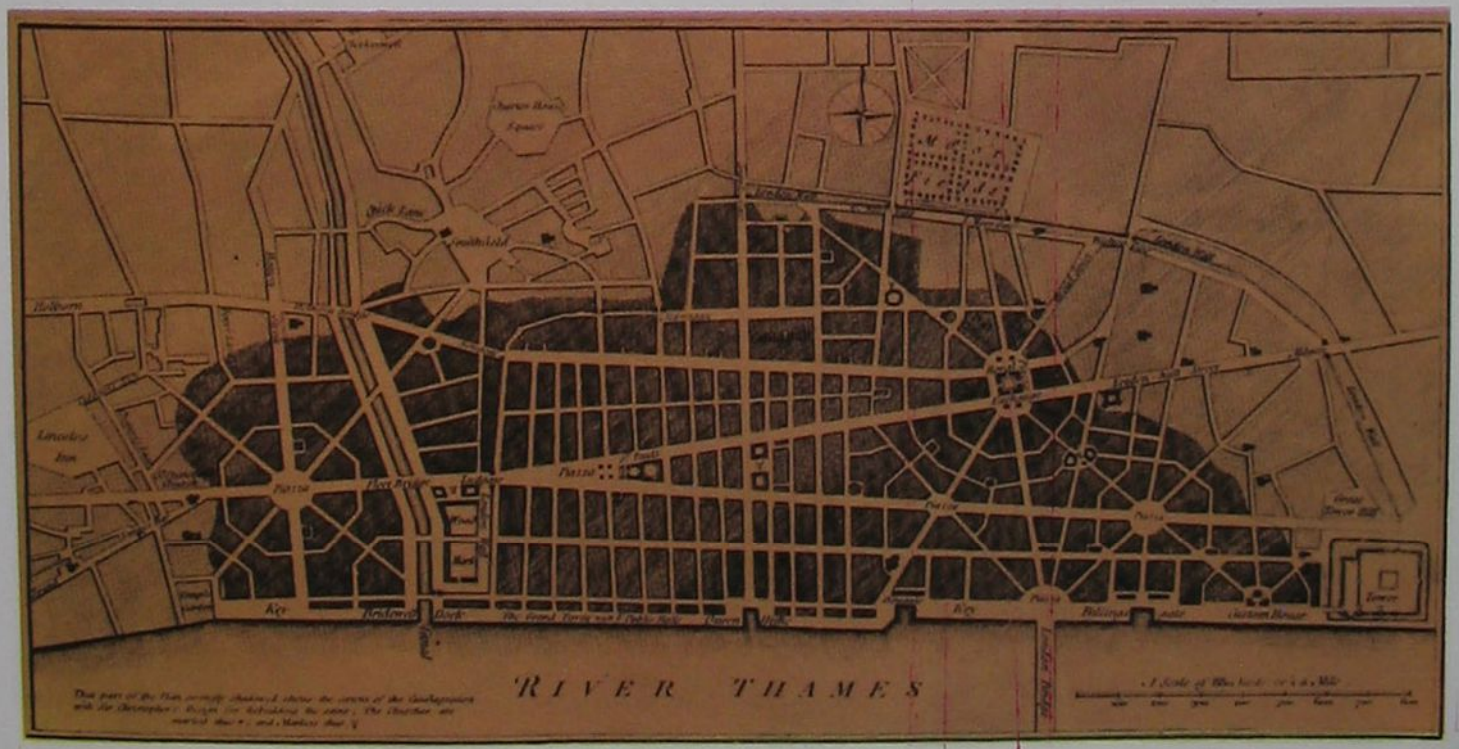
Toussaint L'Ouverture (1743-1803), was a former Negro slave who led Haiti's fight for independence from France. He became ruler of the island. Toussaint gained the name L'Ouverture (meaning *opening)* because of his cleverness in breaking through enemy lines in battle. His real name was Pierre Dominique. Toussaint-Breda.

Toussaint was born a slave in Haiti. He became free, and organized a successful uprising of the slaves in 1791. As leader of the country he made many improvements. When Napoleon became emperor of France he sent a force to capture Toussaint. Toussaint was taken to France and imprisoned.

Town planning Some towns have simply grown piece by piece without any plan, but others have been planned from the beginning. There are ancient towns, like Mohenjo-daro, which were laid out regularly. Roman towns had straight streets, meeting at right angles, and blocks of houses between the streets. Many American towns are like this. There were some planned towns in Europe in the Middle Ages, but most European towns have grown out of villages or open market places. The streets are crooked and curving. Many are too narrow for modern traffic. Paris's medieval streets were redesigned into wide boulevards by Baron Haussmann in the reign of the Emperor Napoleon III (1852-1870).

The towns which grew during the nineteenth century (see Industrial Revolution) were quite unplanned. Growth was very quick and houses were built as cheaply as possible. Britain suffered badly. In the twentieth century there was a

Sir Christopher Wren's plan for rebuilding the City of London after the Great Fire of 1666. Most of it was never carried out.



growing desire to make these old towns better places to live in, and this led to laws being passed (Town and Country Planning Acts) which stopped people building where they liked and as they liked.

Many war-damaged European cities were rebuilt and exciting new lay-outs were planned. Several nations have built new capital cities, planned from the beginning. Australia's federal capital, Canberra, was planned in 1911. Pakistan has built a new capital at Islamabad. The architect was Le Corbusier. Brazil inaugurated her new capital, Brasilia, in 1960. Some of the world's best architects have helped build it.

Toys give pleasure and amusement to children. At the same time most toys help children to develop. Skipping ropes, balls and scooters help them to develop balance and agility. Tops, beads, building bricks and cut-outs teach finger and hand co-ordination.

Many kinds of toys teach children about adult jobs. They also explain how things work. Such toys include toy cars and boats, train sets, miniature kitchen equipment and chemistry sets. Some toys, such as dolls and puppets, broaden children's minds by stimulating their imagination. Children make up stories about toys of this kind, or act out little dramas with them. Other kinds of toys involve competition. These include draughts and many other board games. These teach children how to lose without becoming too upset about it.

Educational toys are designed to teach children reading, arithmetic or some other school subject. Educational toys for young children teach them about such things as shapes and colours.

Toys do not have to be fancy or expensive to be enjoyable. Many children become deeply attached to an old, worn out, stuffed animal that they have had for years. And children can turn almost any discarded object into an interesting plaything. A piece of stick, for example, can become a sword, a bat, a conductor's baton or a fishing rod.

Museums have toys that were made thousands of years ago in ancient Egypt, Greece and Rome. They include many kinds of toys we still use today, such as balls, hoops, animal figures, model ships, dolls and carts.

During the Middle Ages, the making of toys was a craft. It was not until the 1800's that metal stamping and other processes made mass-produced toys possible. Many new kinds of toys were then produced. Some were made with complicated clockwork mechanisms. Dolls were made with skilfully modelled faces of wax or porcelain, and real hair on their heads; they had elaborate wardrobes with silk and velvet dresses trimmed with real lace and fur. Some of these toys are now quite valuable and are collected by adults.

Modern toys are mostly made in large factories. Japan, Germany, Britain and Italy export many toys to other countries. Modern toys reflect the modern world. They include toy robots, computers and spacecraft.

Trade The term *trade* is used for the buying and selling side of business activity. Trade is exchanging goods for money and in some cases, when a barter deal is involved, it is exchanging goods for goods. When you buy a pen, you exchange money for a pen, but you are not engaged in trade as you are buying the pen for your personal use. But when a shopkeeper buys goods from a wholesaler or a manufacturer to sell to other people, he is engaged in trade. This part of trade is called *retail trade*. The retailer is the last link in the chain of distribution before the product reaches the *consumer* (the person who uses it). The other part of trade, *wholesale trade*, involves buying goods from manufacturers in large

Opposite: Children press their faces to the window of a toy shop.

quantities and selling them to retailers. Some manufacturers may sell their products direct to retailers or to consumers.

The retailer performs a very useful function in the community by holding stocks, selling goods in small amounts, and meeting the irregular demands of his customers. The organization in the retail trade may be a large department store selling a wide range of goods or a small corner grocery store catering for the individual needs of the local neighbourhood.

The wholesaler buys and stores goods in large quantity. A wholesaler usually deals in one type of goods, such as furniture or electrical goods. Some large wholesalers organized on a national basis – that is, supplying the type of goods they deal in throughout the country – may be able to buy the whole of a manufacturer's output. Such a wholesaler is sometimes called a *sole agent*.

Domestic trade is a term used for buying and selling goods produced and consumed within a country. But when trade involves moving goods from one country to another, it is called *international trade*. International trade brings people a variety of goods from various countries of the world. The goods that a country sells to another are called *exports*. The goods that a country buys from other countries are called *imports*. Few countries in the world today are self-sufficient. Almost all countries rely on imports from other countries. The industrialized countries export manufactured goods, but usually have to rely on other countries for their raw materials. By importing goods, a country is able to obtain products that it cannot produce for itself. Sometimes a country may find that it can obtain certain goods more cheaply from other countries than it would cost to produce them itself.

International trade is a complicated transaction as it involves many different currencies. Banks and other financial institutions help importers and exporters by exchanging one currency for another. The rates of exchange between currencies depend on the supply and demand for the currencies concerned.

Trade unions are organizations or associations of workers. They are formed to protect the working conditions and increase the wages of workers. Trade Unions were first formed in Britain nearly two hundred years ago. As factories increased (see Industrial Revolution) so did the number and size of trade unions. They spread from Britain round the whole world, as the factory system spread.

British trade unions were organized in three different ways. The oldest trade unions were *craft unions*; their members had a common skill (carpentry for example) but might work in many different industries. The second kind of union, the *general union*, was for those left out of craft unions, the unskilled labourers. In the twentieth century the idea that each

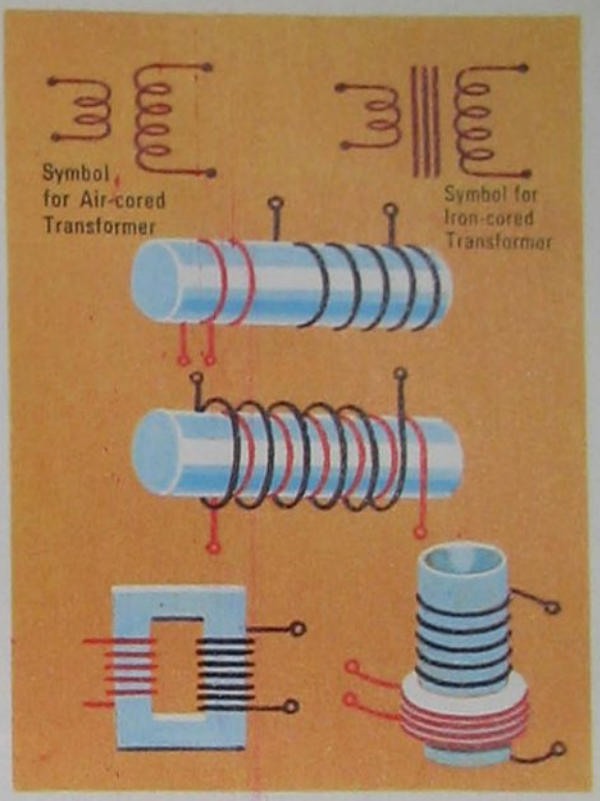
IN THIS BUILDING
ON MARCH 19TH, 1834
THE SIX TOLPUDDLE MARTYRS WERE SENTENCED
TO SEVEN YEARS TRANSPORTATION
FOR THEIR PART IN THE FOUNDING
OF RURAL TRADE UNIONISM

Above: A plaque to commemorate the Tolpuddle Martyrs, six Dorchester labourers prosecuted for 'administering unlawful oaths'. In the early days of Trade Unionism the attitude of the authorities was extremely repressive.
Below: Members of the Electrical Trades Union marching in protest against the closing of a plant.

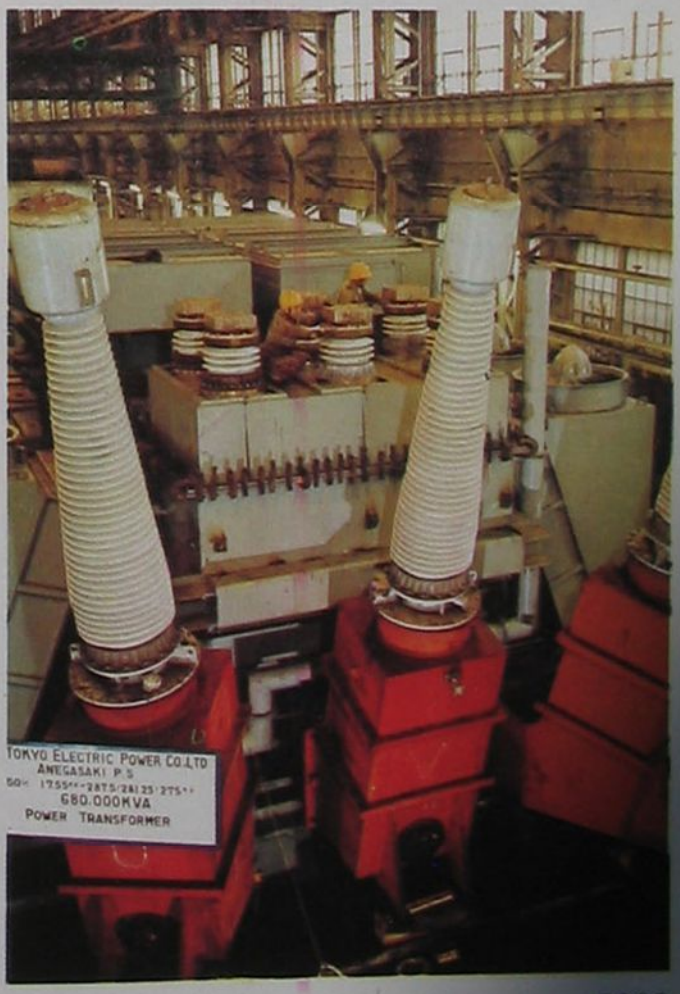
industry should have one union only, *industrial unionism*, began to spread. This has been adopted much more in countries outside Britain.

A trade union normally bargains with employers and reaches an agreement as to the wages which will be paid. This is called *negotiating*. When agreement cannot be reached the employer may refuse to pay his men, to employ them, unless they accept his terms; this is called a *lock-out*. When the trade union stops its members working, in order to get their way, it is a *strike*. Strikes can cause loss to the employer as well as to the whole country.

The right to strike is a necessary democratic right. Without it trade unions would become useless and workers defenceless in face of their employers. But many strikes are caused by conflicts between trade unions. And others result from bad relations between the workers' and managements' representatives in factories and other places of work.



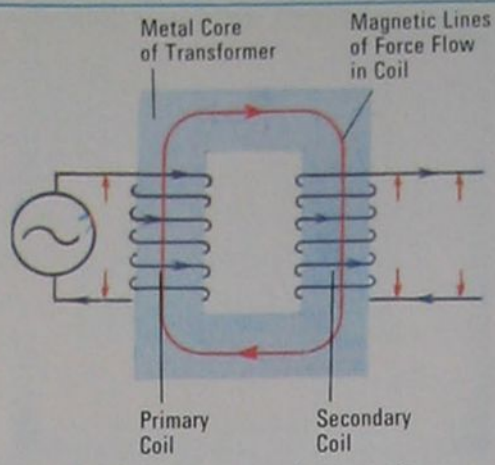
Above: Some typical ways of winding coils on transformers.
Below: Large transformers are frequently designed as three-phase units. The one illustrated has a rating of 680,000 kilowatts.



Transformers are devices for changing the value of a voltage, up or down. Large amounts of electrical power are transmitted between power stations and consumers with the greatest efficiency if the voltages involved are very high. Transformers at the power station change the voltage up to hundreds of thousands of volts. Other transformers change the voltage back down again to the standard voltage of the domestic mains supply (this varies from country to country). The voltage reduction is done as close as possible to the homes in which the power will be used.

A "hi-fi" record amplifier takes the voltage from the mains and feeds it to transformers which convert it to a lower voltage to work its heaters (filaments) in the radio valves (tubes): a transformer in a television receiver increases mains voltage to about 10,000 volts to work the cathode-ray tube.

Most transformers consist of two sepa-



A primary coil—the input coil of a transformer.

rate coils of insulated wire wound round a soft iron core. The voltage to be changed is connected to one winding, which is called the *primary*; the new voltage is taken from the other winding, which is known as the *secondary*.

As the current flows through the primary it sets up a magnetic field which also cuts the secondary. Transformers will work on alternating current only because this type of current is continuously rising and falling and changing direction and so its magnetic field is continuously cutting the secondary as it rises and falls. This is just what is needed to induce the required voltage in the secondary winding.

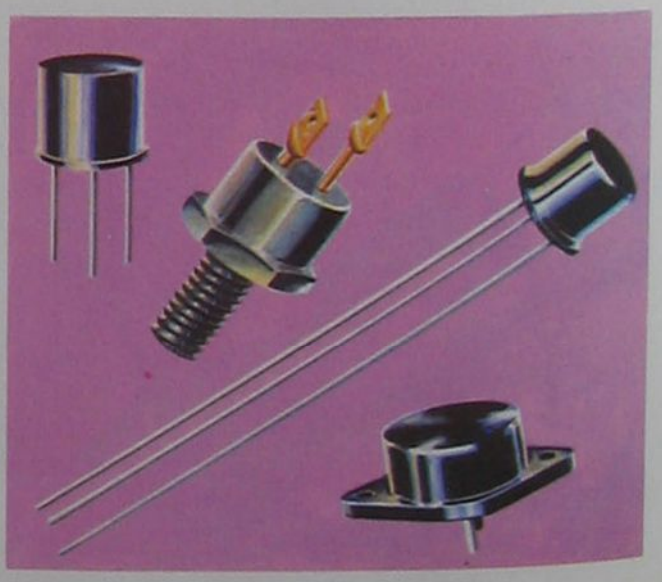
We can arrange to have any voltage we want in the secondary by changing the number of turns. If it has more turns than the primary, then the secondary voltage will be greater than the primary voltage and vice-versa.

Transistors The invention of this device was one of the most important of the twentieth century. It has, among other things, made the modern fast computer and world-wide telephone and television links possible.

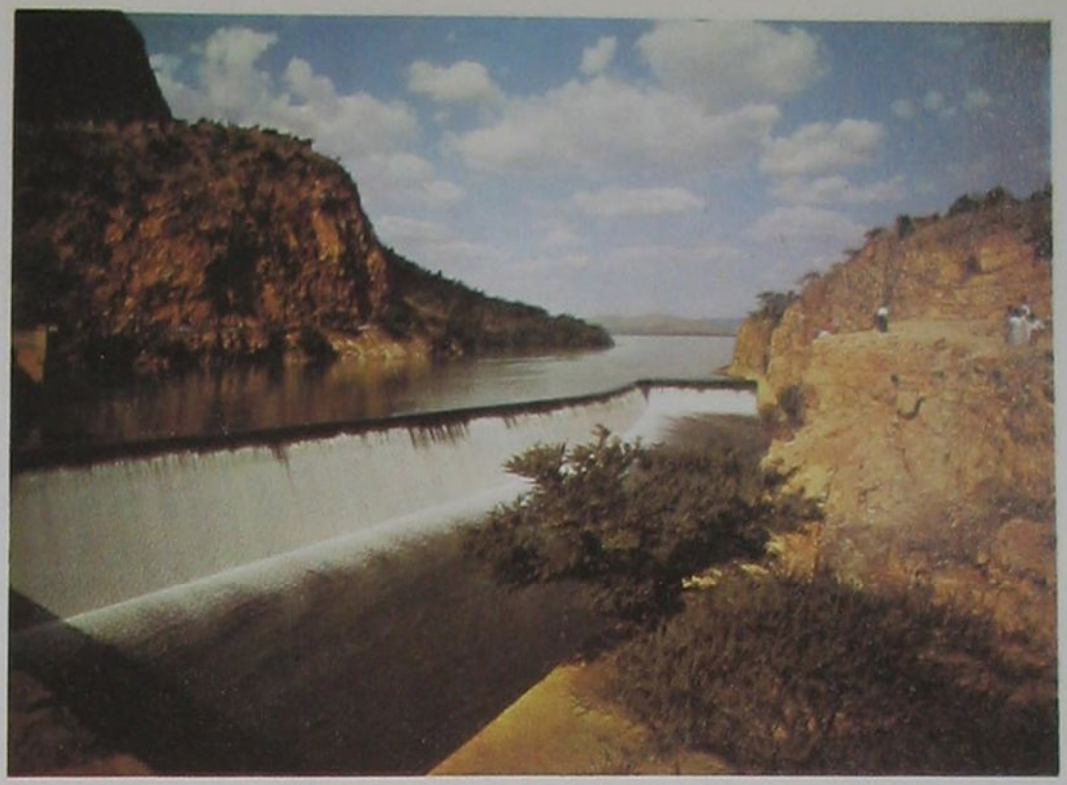
Transistors are usually made from either germanium or silicon. These are two members of a rather special group of elements known as *semiconductors*. They do not carry electric current as easily as an electrical conductor such as copper; but they are not complete insulators. To make them suitable for use in transistors, a small percentage of what are called *impurity atoms* are added. The simplest germanium transistor (a diode), for example, is made by adding arsenic to one piece of germanium and aluminium to an adjoining piece of germanium. Both of these impurities make the germanium a better conductor—but only in one direction. The *carriers* as they are called, introduced by the impurities, flow only towards the positive side of the battery in the section containing arsenic and towards the negative side of the battery in the section containing aluminium. This means that current will flow through the two joined sections only if the positive side of the battery is connected to the section containing aluminium and the negative side to the other section. The germanium is a one-way device, or *rectifier*.

Transistor amplifiers consist of a layer doped with aluminium sandwiched between two layers doped with arsenic. The large current flowing between the two ends of the sandwich, called the *emitter* and the *collector* can be controlled by a very small voltage applied between the centre section, the *base*, and the emitter. In other words this voltage is amplified. Various other arrangements are also used. Today silicon is perhaps even more important than germanium.

Some of the many shapes and sizes of transistors.



The spillway of the Hartbeespoort Dam in the Transvaal.



Transvaal is a province in north-eastern South Africa, lying between the Vaal and Limpopo rivers. Its capital, Pretoria, is the nation's administrative capital, and Johannesburg is the country's largest city. Much of the province's 110,450 square miles consists of a plateau known as the Highveld. Within this region is the Witwatersrand, containing one of the world's richest goldfields. In the east are the Drakensberg range of mountains and Kruger National Park, a vast game reserve and tourist attraction.

The Transvaal's mineral wealth is varied. Besides gold, other metals mined there are platinum, chromium, and iron. Industries manufacture steel, chemicals and machinery. Because rainfall is sometimes scarce, many farmers in the province have to rely on irrigation. Maize, cotton, tobacco and citrus fruits are grown.

Boer settlers, who had trekked from Cape Colony, founded the Transvaal in 1836. Friction between the Boers and the new British settlers led to the Boer War (1899-1902), in which Britain was victorious. The colony joined the Union of South Africa in 1910. Today, more than 6,250,000 inhabitants live in the Transvaal, the large majority of whom are Bantu.

The discovery of gold in the Transvaal, and the harsh treatment given there to immigrant miners, were among the main causes of the South African or Boer War of 1899 to 1902.

Treaties and alliances are formal agreements between states. Treaties may be bilateral (between two states) or multilateral (between any number of states). They are only binding on the states that actually sign them. Treaties may be for an indefinite period (such as the treaty signed in Rome which established the European Economic Community) or for a specific number of years, as for example, the Treaty of Dunkirk which was signed by the British and French governments in 1947 for a period of fifty years. When treaties are made for a limited number of years, they often contain provision for revision before they actually expire.

Most treaties are freely negotiated between individual states on the basis of equality, but some are imposed. After a war, the winning powers normally dictate the treaty imposed on the conquered states. The Allies, in 1919-20, worked out treaties for Germany, Austria and Bul-

Part of the so-called 'Scrap of Paper' Treaty, April 1839. This treaty was drawn up between Great Britain, Austria, Prussia and Russia on one hand, and Belgium on the other, and concerned territorial questions involving Belgium and the Netherlands. The signature at the top is that of Lord Palmerston, then Foreign Secretary, later Prime Minister.

garia. In 1946 treaties were imposed on Italy, Finland, Hungary and Rumania.

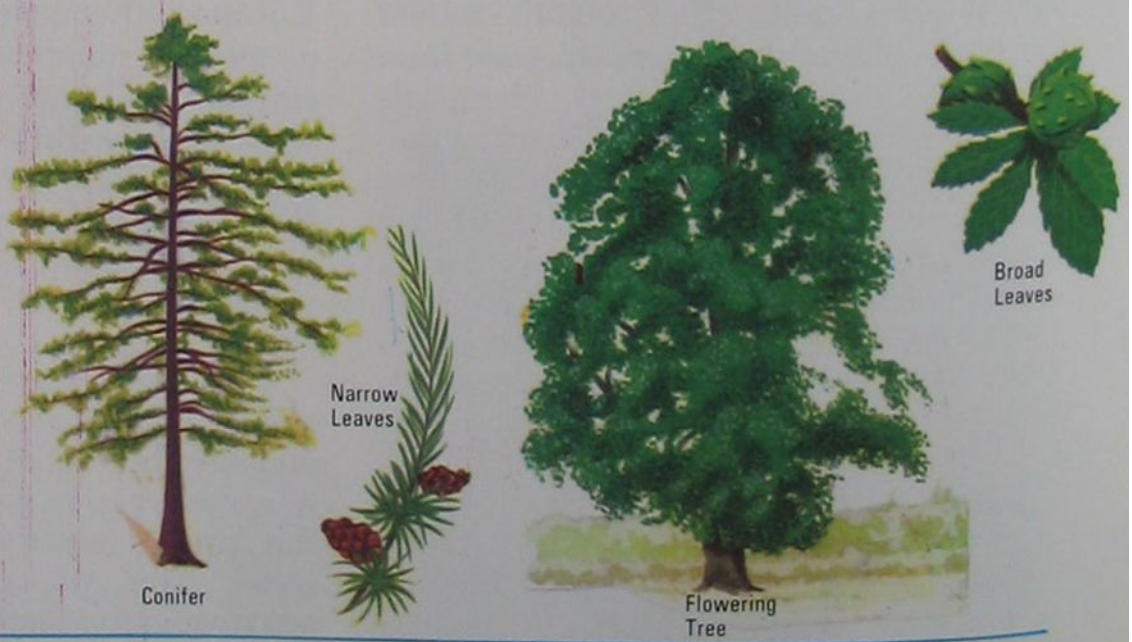
Treaties deal with all kinds of relations between states, such as trade, migration, over-flying rights, taxation, cultural exchanges, extradition, and provision for joint social security arrangements. When states agree to a common defence policy and guarantee each other's territory, this is an alliance. When one country in an alliance is attacked by another state or states outside it, all the members of the alliance must go to the aid of the victim. An alliance requires the joint planning of military, air and naval policies by its members, so that they are ready to resist invading forces. Germany and Austria-Hungary were allies from 1879 and were joined by Italy in 1882 to form the Triple Alliance; France and Russia signed an alliance in 1894; and rival alliances developed in Europe in the years before the First World War.

After the Second World War, a new pattern of alliances emerged when the North Atlantic Treaty was signed in April 1949. The twelve original members include the U.S.A., U.K., France and Italy. By 1955 membership had increased to fifteen, including West Germany. In May 1955, the Soviet Union formed the Warsaw Pact with its eastern European neighbours. The same year, the South-East Asia Treaty Organisation (SEATO) was formed. Its aim is to contain Communist aggression in south-east Asia. Its members include Australia, New Zealand and the United States.

Trees are the most obvious members of the plant kingdom. One redwood tree in North America is more than 360 feet high. At the other end of the scale, trees such as holly and mountain ash may be full-grown at 15 feet, and are distinguishable from large shrubs only by their dominant main stem or trunk. Shrubs typically have a number of similar sized main stems, and, of course, do not grow so large.

Trees are perennials and they grow bigger every year. They grow taller and their branches grow thicker. The tips of their branches house growing points which bring about increases in length,

There are two groups of trees: the Gymnosperms, containing the conifers, such as pines and firs, and the Angiosperms, such as oaks and elms, which have true flowers.



while a ring of tissue in their trunks and older branches produces more cells to increase the girth.

Conifers are usually pyramid-shaped and have thin, needle-shaped leaves that clothe the branches all the year round. Not all evergreen trees are conifers, of course. Many have broad leaves, although most of these live in tropical rain forests. The world's deciduous trees live mainly in the temperate regions.

All trees apart from conifers produce flowers, although they may not be very obvious. Most trees rely on the wind to blow their pollen away. They do not seek the aid of insects, and their flowers are drab. Plenty of trees do bear attractive flowers, however, and some, such as horse chestnut, magnolia, and frangipani, are among the loveliest plants on earth.

Trees are of immense importance to Man. They conserve the soil by checking wind and water erosion. They also provide Man with a material indispensable to modern living—timber.

Tristan da Cunha is a group of four small volcanic islands in the mid-South Atlantic. They were discovered in 1506 by a Portuguese admiral who gave his name to them. They have been a British colony since 1816. There is a population of about 280 who live on the main island. The total area is 45 square miles. In 1961, a volcanic eruption forced the population to be evacuated to Britain for two years.

Tropical fish include many small, brightly coloured fish that can be kept in home aquariums. There are about 300 species of tropical fish suitable for this purpose. (See Aquarium.)

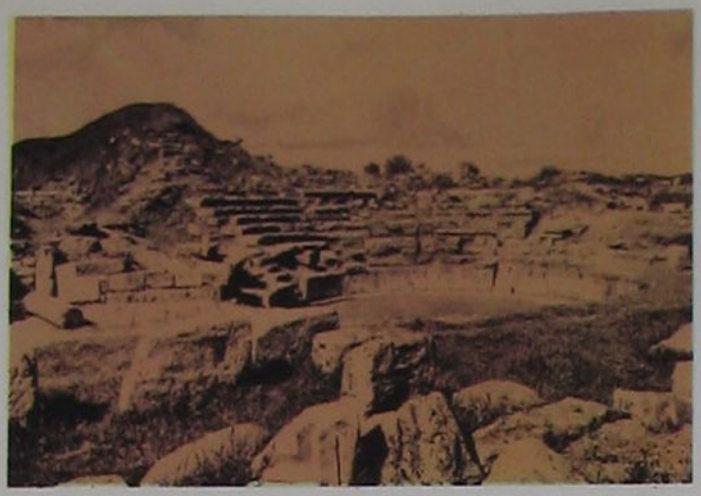
The aquarium should be kept at a temperature of 70° F. (21° C.) by a thermostatically controlled electric heater. A glass cover should be placed over the top to reduce evaporation.

Tropical fish can be bought in pet shops, and many kinds are inexpensive. Many tropical fish owners keep neon tetras, colourful little fish with bright luminous bands along their bodies. Tropical fish breed rapidly, and many of them bear live young. Guppies produce litters of some 30 to 40 live young, and are very popular with aquarium owners, though the parents often eat all their young. Other tropical fish that have live young include the swordtail, the platyfish, and the midnight mollie.

Egg-laying fish include the barbs, a group of brightly coloured fish. The parents should be removed to another aquarium after spawning. The eggs stick to water plants and hatch a day or so after being laid. Rasboras and danios are other egg-laying fish that do well in aquariums.

Some varieties of tropical fish

1. *Rasbora netropho*
2. Yellow Dwarf Cichlid
3. Striped Gourami
4. Black Widow
5. *Copeina guttato*
6. Neon Tetra
7. Midnight Mollie
8. Tiger Barb



Part of an excavated site at Troy.

Troy was for many centuries famous as the legendary site of the Trojan Wars. Generations of scholars believed that Homer's *Iliad* described an imaginary war between Greeks and Trojans, and they believed that no such city had ever existed. The man who proved them wrong was Heinrich Schliemann, a nineteenth-century pioneer of archaeology. Schliemann devoted his fortune and a large part of his life to locating and excavating the site which he believed to have been that of the city of Troy. What he discovered was not one city but many, built layer upon layer in successive generations. Later archaeologists followed him and excavated the site with much more scientific methods.

It is now known that the city Homer wrote about had a real existence, dating back to the earliest settlement in about 3000 B.C. The citizens he described were probably Phrygians, who lived mainly by collecting tribute from passing ships.

The Trojan Wars took place around 1194 B.C., and led to the destruction of Troy. The city was rebuilt many times in later centuries, but by the nineteenth century it had disappeared. Schliemann selected the Turkish village of Hisarlik near the entrance to the Dardanelles as the nearest inhabited spot to ancient Troy and he proved to be correct. The Romans believed that their own ancestors were descended from Prince Aeneas who fled from Troy after its destruction, but this has no basis in fact.

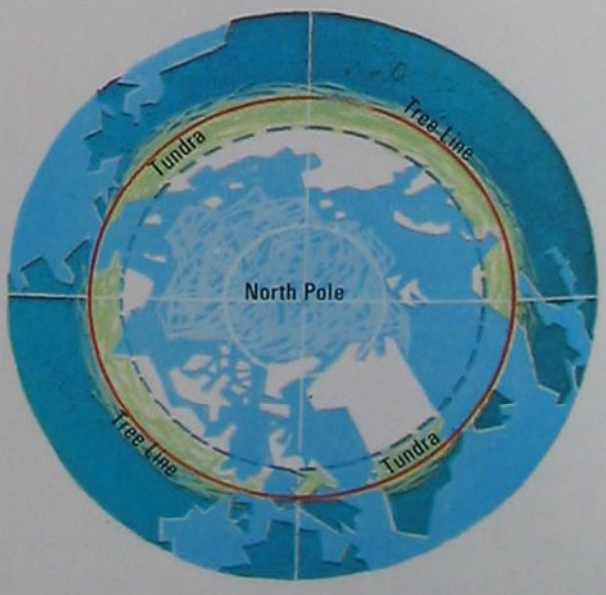
Tuatara is a rare, lizard-like reptile found only on a few islands off the coasts of New Zealand. The tuatara grows up to about 2½ feet long. A scaly crest runs down the middle of its head and back. It differs from lizards in having a third, horizontal, eyelid, and a bone behind the eye that is lacking in true lizards. It is the sole survivor of an otherwise extinct order of prehistoric reptiles. It lives in burrows in the ground.

Tundra The intensely cold, treeless plains lying to the north of the coniferous forests in North America, Europe and Asia are known as *tundras*. In these regions, the temperature never rises above freezing point except for about two months in summer, when there is continual daylight.

Because of the frozen condition of the soil, and strong winter winds, tree growth is impossible, though dwarf birches and willows are occasionally found. For the most part, the vegetation consists of mosses and lichens, with berried plants growing in more sheltered places.

Musk-oxen, caribou and reindeer can live in the tundra, as well as small fur-

The tundra lies between the tree line and the frozen polar regions. It occupies about five million square miles of land.



bearing animals and many wild-fowl. Mosquitoes breed in shallow pools in warmer periods of the year. But it is chiefly reindeer who wander these regions, moving gradually to the edges of the forest in the extremes of winter. Once, the only transport was by sleigh in winter and canoe in summer, but air transport is now increasing.

Tunisia is an Arab country on the northern coast of Africa. It is bounded by the Mediterranean Sea, Libya, and Algeria. The country's area is 48,332 square miles. Its southern region is part of the Sahara desert. The north has fertile, wooded areas and coastal plains. About 5,100,000 people live in Tunisia. Nearly all are Muslims. Tunis, the capital, is the largest city and port.

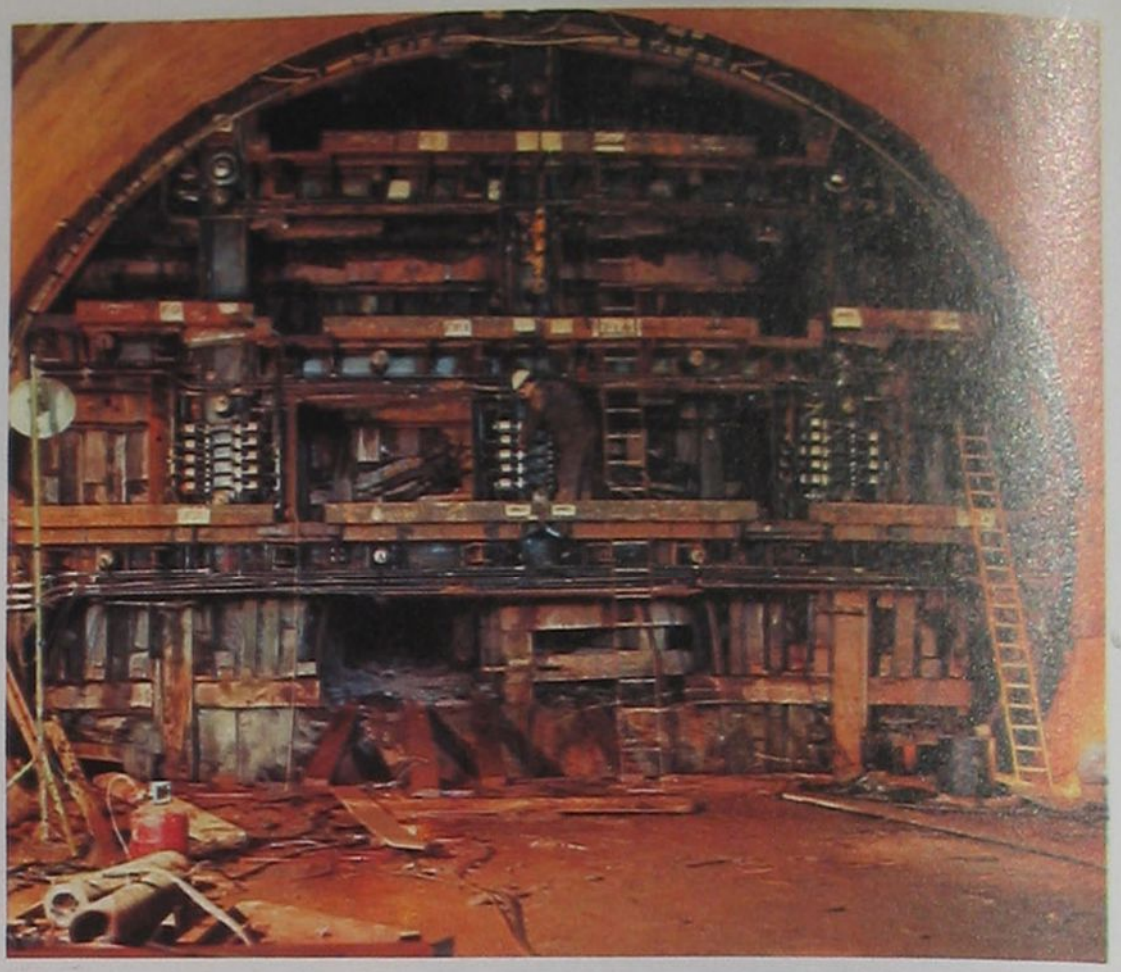
Farming is the chief occupation of the people. Wheat, olive oil, wine and dates are exported. Valuable deposits of phosphates are mined. Tourism is a rapidly growing industry. The ancient Phoenician city of Carthage stood near Tunis. Tunisia became a protectorate of France in 1881. It became independent in 1956.

A location map of Tunisia.

Tunnelling Builders of roads and railways often overcome natural obstacles such as mountains and rivers by boring tunnels beneath them. Tunnelling through mountains avoids many miles of steep, winding routes.

The harbour of the Tunisian port of Bizerta is overlooked by white-washed houses. The two boys are wearing the traditional 'fez' of the Muslim male.

Sonia Halliday



Tunnelling shields are clever devices for driving tunnels and lining them at the same time. They are used when tunnelling through fairly soft soil such as clay to prevent the newly dug tunnel from collapsing.

The longest road and railway tunnels in the world run through the Alps in Europe. The Mont Blanc road tunnel between France and Italy runs for over seven miles beneath Europe's highest mountain.

Many of the world's largest cities, including Paris, London, and New York, have underground railway systems which run in tunnels beneath the streets. (See Underground railway.)

But the longest and most common tunnels are the kind we never see—the aqueducts which carry water to our cities. (See Aqueduct.)

Tunnelling methods depend on whether the soil is hard, soft, or likely to let through water. In hard rock, tunnels are driven by blasting with explosives. Powerful rock drills driven by compressed air bore holes into the rock face. Sometimes they are mounted together on a frame called a 'jumbo', which runs on rails. Explosives placed in the holes shatter the rock. The rock is removed, and the process is repeated.

In soft ground, such as clay, a device called a *tunnelling shield* is used to prevent the newly dug tunnel from collapsing. The shield is like an open-ended tin, with a cutting edge at the open end. Powerful jacks force the shield forward through the soil. Workmen then excavate material under the protection of the shield and line the tunnel with concrete or steel sections. Compressed air is fed to the shield if there is danger of water seeping through during tunnelling.

Another method of building tunnels under water is to use ready-built sections. These sections are floated into

The longest tunnel in the world of any kind is the New York City West Delaware water supply tunnel. It is 85 miles long and has a diameter of 13 feet 6 inches. It was completed in 1945. The longest continuous tunnel for vehicles is the London Transport underground line from Morden to East Finchley. It is 17 miles 528 yards long and was opened in 1939. The largest diameter of any road tunnel is that of the tunnel through Yerba Buena Island, San Francisco, U.S.A. It is 76 feet wide and has two decks.

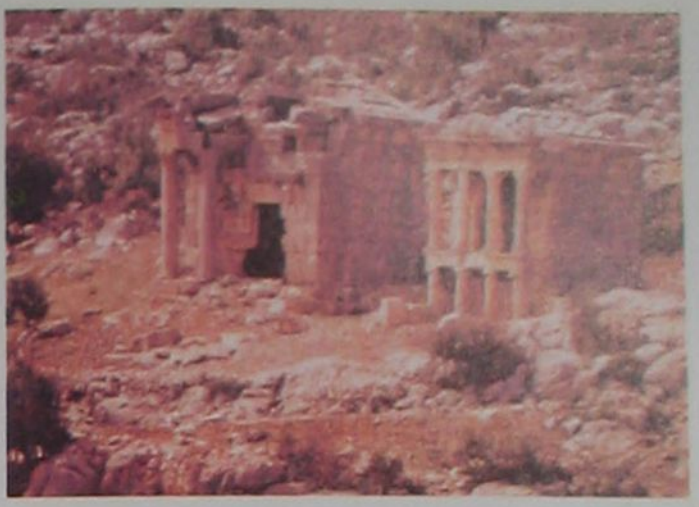
position, sunk into deep trenches, and joined together by divers. This method is often used when the river bed is too soft for normal tunnelling methods.

Turin, a city on the River Po in north-west Italy, is a leading industrial centre. Motor-cars are the chief product. Textiles and vermouth wine are also produced. The city has many lovely parks and gardens, and fine examples of Baroque architecture. It has a population of 1,191,000. Turin was the first capital of a united Italy, from 1861 to 1864.

Turkey is a large, semi-desert country mainly in south-western Asia. The small area of European Turkey is separated from Asian Turkey, called *Anatolia*, by the Sea of Marmara. This tiny sea is connected to the Black Sea, which washes northern Turkey, by the narrow strait called the Bosporus. The Dardanelles link the Sea of Marmara with the Mediterranean. All ships steaming to or from Russia's only ice-free ports—those in the Black Sea—pass through this waterway. (See Bosporus.)

The dry plateau of Anatolia lies between about 2,500 and 6,000 feet above sea level. It is ringed by mountains. Many earthquakes occur in Anatolia. Turkey's coastal climate is mild, but inland temperatures are extreme. Rainfall is moderate in European Turkey, but low in Anatolia. Forests cover much of the northern coastal area. Turkey has large and varied deposits of minerals, especially chromium.

A location map of Turkey.



Above: An ancient tomb in arid country, typical of much of inland Turkey. Below: A ferry on the Bosporus, which separates European from Asian Turkey.

Most Turks are descended from central Asian people who invaded Turkey and intermarried with other people there. About one-twentieth of Turkey's people are wandering herdsmen, called Kurds.

Most Turks are farmers and country-dwellers. But one-twentieth of the people live in Istanbul, a bustling centre of industry and trade, which was once called Constantinople. Almost all Turks are Muslims, but their religion is less strict in Turkey than in other Muslim countries.

Turkey's farmers grow mainly grain, and also cotton, tobacco, sugar-beet and fruits. They keep sheep and goats. Turkey is rapidly developing manufacturing industries.

About 2,700 years ago, Assyrian armies finally destroyed the country's great

Hittite civilization. Many cities and small kingdoms rose and fell before Turkey, then called Asia Minor, became part of the Roman Empire. The Roman Emperor Constantine the Great built Constantinople in A.D. 330. Renamed Byzantium, this city became the centre of the Christian Byzantine empire.

Muslim Seljuk Turks from the east defeated the Byzantine empire in 1071. European Christian armies fought *Crusades* to expel the Turks. In 1243, Mongol horsemen crushed the Seljuks. Ottoman Turks followed the Mongols and gradually established a vast empire extending from central Europe to Arabia, and from Tunisia to Persia. This empire's decline began before 1600, and it collapsed when Turkey was defeated in World War I in 1918.

Mustafa Kemal, an army leader later called Kemal *Ataturk*, which means *Father of the Turks*, took power. He Europeanized Turkey, reformed the language, and modernized the economy. Many quarrels occurred between Turkey and Greece. In the 1960's, these almost exploded into war about Cyprus. (See Cyprus.)

Facts and Figures
Area: 301,300 square miles.
Population: 35,600,000.
Capital: Ankara.
Money Unit: Turkish lira.
Labour force: 66% rural; 34% urban.
Exports: cereals, cotton, tobacco.
Imports: iron and steel, machinery.

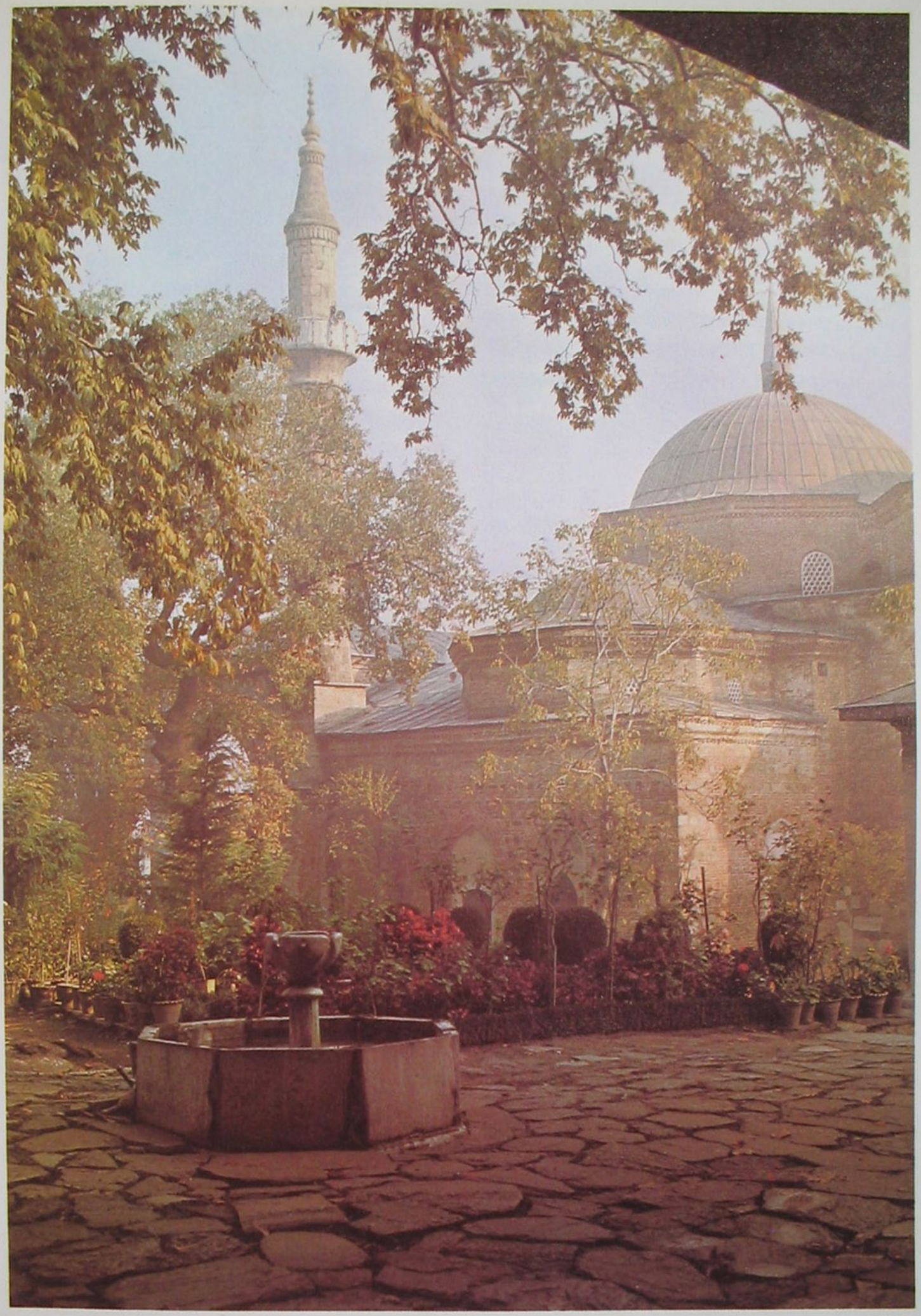
Turks The Turks were one of the nomad tribes which wandered through the northern parts of central Asia. The Seljuk Turks first appear as a group of tribes near Lake Baikal in A.D. 552. They spread westwards and eastwards. By 657 the eastward movement of the Seljuk Turks against China had been driven off by the Tang emperors. So all the Turkish clans moved westwards. They were converted to the Muslim religion and set up a state in the area of Bokhara and Samarkand, the modern Turkmen Soviet Republic.

From this centre they expanded southwards. One group moved through Afghanistan into India in the eleventh century. Mahmud of Ghazni conquered north India. By 1340 Muslim rule had reached even south India. Another group moved into Asia Minor and Arabia. The eastern Roman emperor was defeated in 1071 at the Battle of Melasgird. Saladin led these Turks at the capture of Jerusalem and the Christian countries of Europe began the Crusades to recapture it. The Seljuk Turks took over the Arab empire and the rule of all Muslims when a Turk became Caliph.

The Mongols destroyed this Seljuk Turkish empire. But another Turkish tribe, Ottomans, restored Turkish rule. In 1453 they finally captured the capital

Traditional Turkish costumes at a modern procession. The man in front is wearing medieval armour.

Opposite: The Muradiye Mosque at Bursa in Turkey. Its cemetery contains the tombs of 11 Ottoman princes or princesses.



city of the eastern Roman Empire, Constantinople, and renamed it Istanbul. A Turkish empire was formed, which stretched from the Balkans in south-east Europe to Egypt. Its centre was Asia Minor, modern Turkey. The First World War finally freed the southern European Slavs and the Arabs of Arabia from Turkish rule. A revolution in Turkey overthrew the Caliphate and Mustafa Kemal (Ataturk) began to build a modern Turkish nation.

Turpin, Dick (1706-1739) was an English *highwayman* (robber) who has figured in many romantic legends. The son of an Essex innkeeper, he was apprenticed to a butcher. He soon joined a gang of youths who stole deer and farm animals. As a young man he specialized in ambushing stagecoaches, and robbing travellers on the London to Oxford road.

One story tells of Turpin's wild overnight ride from London to York, a distance of some 200 miles, on his famous horse Black Bess. Turpin was eventually arrested for horse stealing and hanged at York.

Turtles and tortoises are reptiles with bodies protected by two shells, an upper one called a *carapace* and a lower one called a *plastron*. The head and limbs protrude from between the shells and can be withdrawn for protection. The name tortoise is usually given to turtles that live on land.

There are about 250 species of turtle living in tropical and warm temperate regions of the Earth.

Tortoises, or land-living turtles, have highly arched shells and their limbs end in four or five toes.

The Green Turtle lays her eggs in a hole in the sand and then hides them before she returns to the sea.

Most turtles live in water, and several fresh-water kinds are called *terrapins*. Turtles vary in size from about five inches up to five feet in the case of the giant tortoise. Turtles are born from eggs, usually buried in mud or sand.

There are four main kinds of turtle. The largest group is the *Cryptodira*. These turtles can withdraw their heads under the carapace. They are found all over the world, except Australia. They include the land tortoises; several terrapins, including the diamond-back terrapin of America; the musk turtles, which have a musky odour, and the mud turtles, which live in sluggish streams, both American turtles; and the snapping turtles of America, which have a dangerous bite.

Sea turtles are large, with paddle-like limbs. The head cannot be withdrawn. The green turtle is of commercial importance as the source of turtle soup, but it is now becoming rare.

The side-necked and snake-necked turtles withdraw their heads by bending them to one side. These turtles live in rivers in Africa, Australia, and South America.

Soft-shelled turtles have gill-like structures in their throats that enable them to remain under water for long periods. They are fresh-water turtles of North America, Asia and Africa.

Twain, Mark (1835-1910) was a famous American writer and humorist. His real name was Samuel Langhorne Clemens. His pen name, *Mark Twain,* was a term used by riverboat pilots on the Mississippi. It means "two fathoms deep".

Twain was born and brought up in Missouri, on the Mississippi River. He worked for a time as a riverboat pilot. He loved his native region and its people. He gave them immortality in his most popular novels: *The Adventures of Tom Sawyer* (1876) and *Huckleberry Finn* (1884).

The young Twain became a printer. Later he wrote stories and sketches for newspapers, and began to write books. As he became known, he made many lecture tours in America and Europe. People loved his sharp wit and his keen observations. In *Innocents Abroad* (1869) he gave his impressions of the differences between Americans and Europeans.

Twain's later writings became bitter. They reflected personal tragedies, such as the loss of his wife and four children.

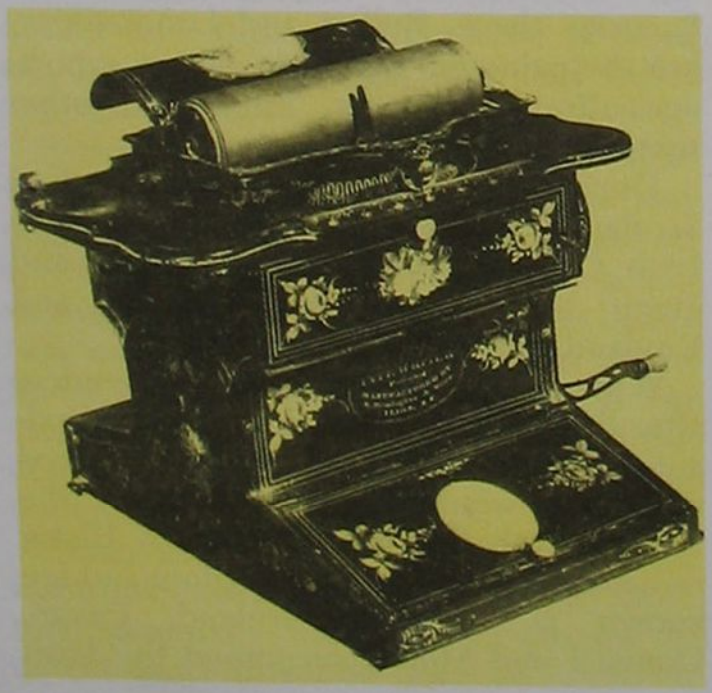
Typewriter There must be few offices today where you cannot hear the sound of a typewriter. The invention of this 'writing machine' in the 1860's greatly improved business efficiency.

The first models sold (1874), called *Remington,* worked in much the same way as modern ones. Striking a letter key on a keyboard presses a metal type bar against an inked tape and on to the paper, which is held in a carriage.

Modern typewriters have many refinements to make typing easier and quicker. They have bells to warn that the end of the line is near, margin setters and releases, back spacers, and so on. Proportional-spacing typewriters can type with a right-hand margin, just like printing machines. Electric typewriters are faster and more silent than manual ones.

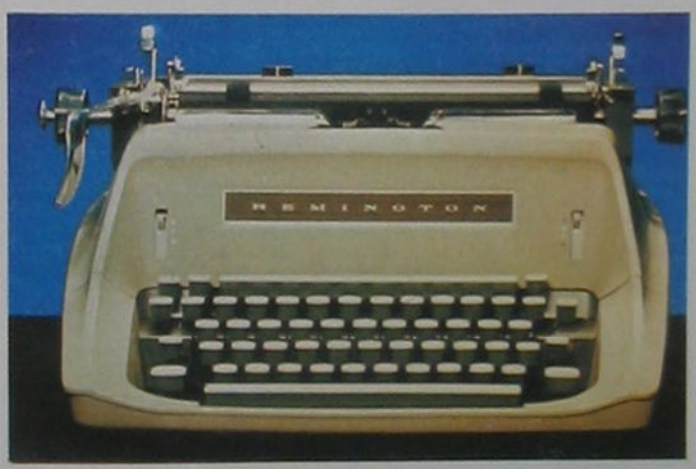
Tyres form the outer part of a bicycle, car, aeroplane, or other vehicle wheel – the part that touches the ground. Most tyres are made of strong, *vulcanized* (heat-treated) rubber, and are filled with air under pressure in order to cushion the ride. The outside surface of a tyre usually has deeply indented patterns, called *treads,* which help it to grip the road. Many tyres are designed in two parts – a thin *inner tube,* which holds the air, and the outer *casing,* which fits on to the rim of the wheel. Tubeless tyres have been developed.

The *pneumatic* or air-filled tyre was first used in the late 1800's. Before that, metal or solid rubber tyres were used.



Left: The first commercial typewriters were sold in 1874. This Remington Model I was manufactured in 1876.

Below: A modern typewriter made by the same company.



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UAR see Egypt.

Uganda is a republic in eastern Africa. Its area is 91,134 square miles. Kampala is the capital and largest city. Uganda's countryside varies from grasslands with a few trees in the north to forests in the south. Lakes take up some of the area. They include two large lakes, Victoria in the centre of Uganda and Albert on its western boundary. The country has a moderate climate and magnificent wild life. The population is 9,549,000. The people belong to many tribes, of which the Baganda is the largest. Most of them live as farmers. They grow coffee, cotton and tea. The country exports some copper and other minerals. Uganda was formerly a British protectorate. It became independent in 1962. In 1972, under a military government, thousands of Asians were expelled.

A location map of Uganda.

Ulster is the name often given to the province of Northern Ireland, which is part of the United Kingdom. Ulster was originally one of the four ancient kingdoms of Ireland, together with Munster, Leinster and Connaught. In 1585, when Ireland was under English rule, Ulster was established as a province made up of eight Irish counties – Antrim, Armagh, Down, Donegal, Fermanagh, Monaghan, Tyrone and Coleraine, which was later called Londonderry. County Cavan was added later.

Ulster is made up of a plain surrounded by ranges of low mountains. In the north-east are the Antrim mountains, in the north-west are the Sperrin Mountains and in the south-west are the mountains of Mourne where Slieve Donard (2,796 feet) is the highest peak in the province. Much of the rest of Ulster is a gently rolling plateau about 500 feet above sea level. The main rivers are the Foyle and the Lower Bann, both of which flow north into the Atlantic. The Upper Bann flows into *lough* (lake) Neagh, the largest lake in the British Isles (147 square miles).

Farming is the major occupation in Ulster and the soil is fertile. Potatoes and oats are important crops. Most farms keep cattle and poultry, and eggs and beef are exported. Many of the farmers grow flax for the linen industry. Most of the industry in the province is centred around Belfast, (population 360,000) the capital of Northern Ireland, and Londonderry (population 52,000). Belfast has large shipbuilding yards and most of the important Irish linen industry is carried on in that area. Londonderry is noted for its clothing industry. There are some light engineering and food processing factories there. Belfast and Londonderry are the principal sea ports. Ulster exports agricultural products, linen and other textiles, and ships.

During the reign of James I (VI of Scotland), land was confiscated from the Irish Catholic inhabitants of Ulster and given to settlers from Scotland and England who were Protestants.

When Ireland became independent after the Second World War, the descendants of these Protestant settlers feared that they would be dominated by the Roman Catholics. Six counties of Ulster remained in the United Kingdom and are known as Northern Ireland. Cavan, Donegal and Monaghan joined the Irish

Above: This map shows the location of Ulster. The solid black is the area of Northern Ireland, and the black lines show the extent of the historical province of Ulster.

Right: Harvest time in Glen Antrim, in the north-east of the province.

Free State. Until 1972, Ulster had its own parliament which governed home affairs. Following rioting and terrorism between the Catholics and Protestants the parliament was dissolved and in 1973 Ulster was ruled by the British government. (See Ireland.)

Ultrasonics is the name given to very high sounds indeed—so high that we cannot hear them, though some of them can be heard by dogs, bats and other animals.

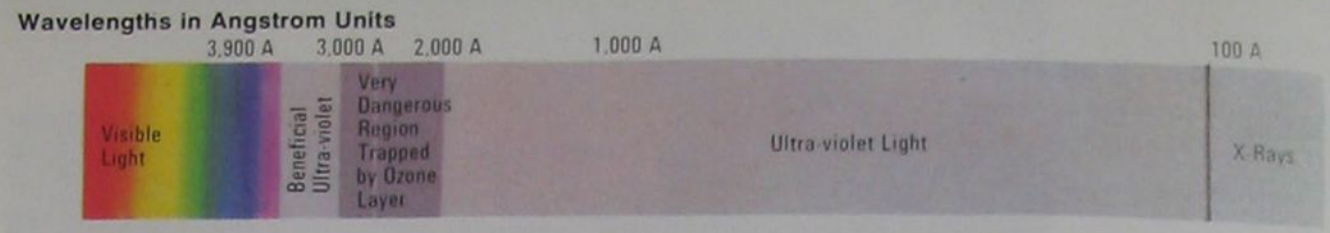
Although they cannot be heard, ultrasonics have many uses in science and engineering. These high sounds can be concentrated into a very accurate beam, so that they can be detected in one direction only. One application of this directional property of ultrasonics is in *Sonar*, the device used for measuring the depth of the ocean and for signalling under water (see Sonar).

Sonar works by timing the echo of an ultrasonic wave (see Echo). In the same way, scientists can use ultrasonics to detect flaws in metal, such as cracks in railway lines. The flaws send back echoes, which instruments can detect.

The impact of ultrasonic waves sets up vibrations. For this reason, it is possible to use them for washing clothes. In an ultrasonic washing machine, the dirt particles are literally shaken out of the clothes. Similar vibrations are used to sterilize surgical instruments and for industrial cleaning. Dentists use ultrasonic drills, which can cut away the decayed parts of teeth painlessly.

Ultra-violet light is a form of electromagnetic radiation which has a wavelength shorter than visible violet light. Sometimes called 'black light', ultraviolet rays are invisible. They can, however, expose photographic film and cause certain chemicals to glow or *fluoresce*.

Strong ultra-violet radiation is given off by the Sun. Most of it is absorbed by the Earth's atmosphere, but enough of it reaches the surface to slightly burn or 'tan' the skin. Over-exposure to ultraviolet rays, either from the Sun or from



Above: Ultra-violet rays have wavelengths of from 3900A (bordering the visible spectrum) to 120A (Bordering the X-ray region).

Some minerals take on new colours when exposed to ultra-violet light. Some specimens of fluorite fluoresce with a strange bluish colour.

'sun lamps' can be dangerous; not only can severe burns be caused, but chemicals called *histamines* formed in the burned skin can enter the blood and cause a form of toxic poisoning.

Many kinds of disease-causing bacteria can be killed by exposure to ultra-violet rays, and for this reason ultra-violet is now being used as a way of purifying the air and sterilizing surgical instruments.

Underground railways Traffic congestion is not just a modern problem. Even in the mid-1800's, the streets of London were becoming blocked with horse-drawn carriages and buses. Obviously, a railway was required but, since there was no room for it on the ground, it had to go underground.

One problem was that at the time there were only steam locomotives available for the railways. This ruled out any possibilities of deep railway tunnels, because the steam and smoke would be suffocating. The answer was to dig a deep cutting, roof it over, and insert ventilation shafts. This method of tunnel building is called *cut and cover.*

The first four-mile section of London's underground system, operated by the Metropolitan Railway, was opened in 1863. In 1890, the first deep-level underground railway, or *tube*, was opened, which ran beneath the River Thames. The tunnels for it had been bored by a device called a *tunnelling shield.* (See Tunnelling.) Deep-level tubes had become possible because of the invention in 1879 of an electric locomotive.

In the early 1900's many other countries began operating underground systems. The Paris Métro was opened in 1900 and has remained more or less in its original state. The trains have rubber tyres, however, which makes the Metro quieter than most other tube systems. The New York City *subway* opened in 1904. Today it carries more than 1,600 million passengers a year.

London's tube system is still the world's biggest. It has more than 240 miles of route, including 70 miles of bored tunnel. At Hampstead, in north-west London, the tube is 190 feet below ground. The tubes had to be built so deep in London because the soil was too weak higher up. London's deep tubes served as excellent air-raid shelters during the Second World War (1939-45) from the nightly blitz by German bombers.

All underground systems now work by electricity. The electric-motor units are placed at intervals along the train. This is called *multiple-unit working.* The motors pick up their driving current from conductor rails alongside the track.

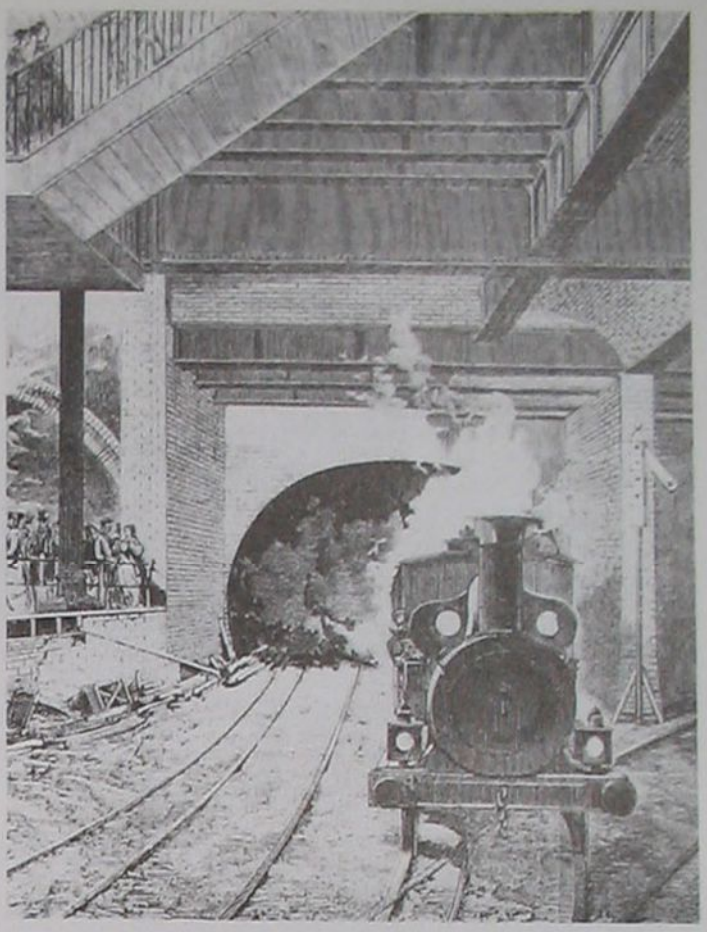
The carriages are well-designed for their task of carrying many people for

short distances. Their seats are set close together. There is plenty of space for people to stand and straps for them to hang on. The doors are sliding so that they do not take up valuable space.

On some underground systems one train may follow another along the same line at an interval of little more than a minute in the busy 'rush-hour' periods. The use of computers and automatic systems has made possible the split-second control necessary to operate safely in these conditions.

To cope with the periodic flood of passengers from the trains, stations have lifts and moving staircases, or *escalators*, to carry them to street level. Some stations even have moving platforms to speed the flow.

Uniforms are specially designed sets of clothing. They usually indicate that the



Above: The junction of the Great Northern, Midland, and Metropolitan railways at King's Cross in 1868.

Below: The Victoria Line is the most recent addition to London's Underground system.

Uniforms designed centuries ago are sometimes worn for ceremonial duties or occasions. The Swiss guard wears colourful uniforms designed by Michelangelo in the 16th century, while in London the Yeomen Warders of the Tower wear Tudor dress, and the pikemen of the Honourable Artillery Company uniforms of Cromwellian times.

wearers carry out definite jobs and duties, and belong to special groups. Often, the wearers of uniforms have some kind of authority over other people. Many people who wear uniforms also hold a *rank*—such as corporal, inspector or staff nurse.

Some uniforms are worn as a means of recognition. In some cases uniforms are designed for practical use. Firemen's boots and helmets help them in fire-fighting. Uniforms often make the wearers look important so that they can exercise authority more easily. The plumed hats of admirals and ambassadors are designed to inspire respect.

Soldiers have worn uniforms for thousands of years. In war, uniforms gave some kind of legal protection, because soldiers captured without uniforms were often killed as spies.

Talking points

* Discuss the reasons why armies put their soldiers into uniforms. What was the purpose of the brightly coloured uniforms worn in the days before camouflage was introduced?
* It could be said that when a man puts on a uniform he loses some of his individuality as a person. Would you agree with this statement?
* A policeman in uniform, on duty, is regarded in a different way from when he is off duty and wearing civilian clothes. How does the uniform help the policeman to carry out his work?

Articles to read

Armed forces; Costume; Police.

United Kingdom consists of England, Wales, Scotland and Northern Ireland. Its full name is United Kingdom of Great Britain and Northern Ireland. For a description of the geography of the United Kingdom, see British Isles, England, Scotland and Wales. See also Ulster.

The United Kingdom is a constitutional monarchy. The head of state is the Queen, who rules with the aid of a parliament.

For centuries armies wore colourful uniforms which denoted regiments and ranks but which often made them easy to see. Modern khaki was introduced to make them fade into the surrounding countryside. This Victorian print shows an officer in the Rifle Brigade.

This scene in the Cotswolds is typical of many parts of the United Kingdom.

Parliament consists of two houses. The House of Lords consists of men and women with titles. Some inherit their titles. Others are given titles in recognition of their services to the country.

The other house, the House of Commons, has members elected by the people. Almost all the Commons belong to a political party. Normally, the party with the most members forms the government.

The real power in the United Kingdom is held by the prime minister, who is the leader of the government party. He is helped by a number of ministers, each responsible for some part of the government's work, such as finance or housing.

The United Kingdom government rules a number of territories in other parts of the world, called *colonies* and *protectorates*. Many countries formerly ruled by the United Kingdom now belong to the Commonwealth.

The United Kingdom of Great Britain and Ireland was formed in 1801, when the parliaments of Great Britain and Ireland were united. In 1921, Ireland was split into two parts, each with its own parliament. Northern Ireland became part of the United Kingdom of Great Britain and Northern Ireland, and continued to elect members to the British parliament. The Irish Free State (now the Republic of Ireland) became independent.

Facts and Figures
Area: 94,214 square miles.
Population: 55,522,000.
Capital: London.
Money Unit: pound sterling (£).
Labour Force: 80% urban, 20% rural.
Exports: machinery, manufactured goods.
Imports: foodstuffs, raw materials.

United Nations As the Second World War drew to a close, President Roosevelt of the U.S.A. wanted to make sure that the cooperation of the wartime allies con-

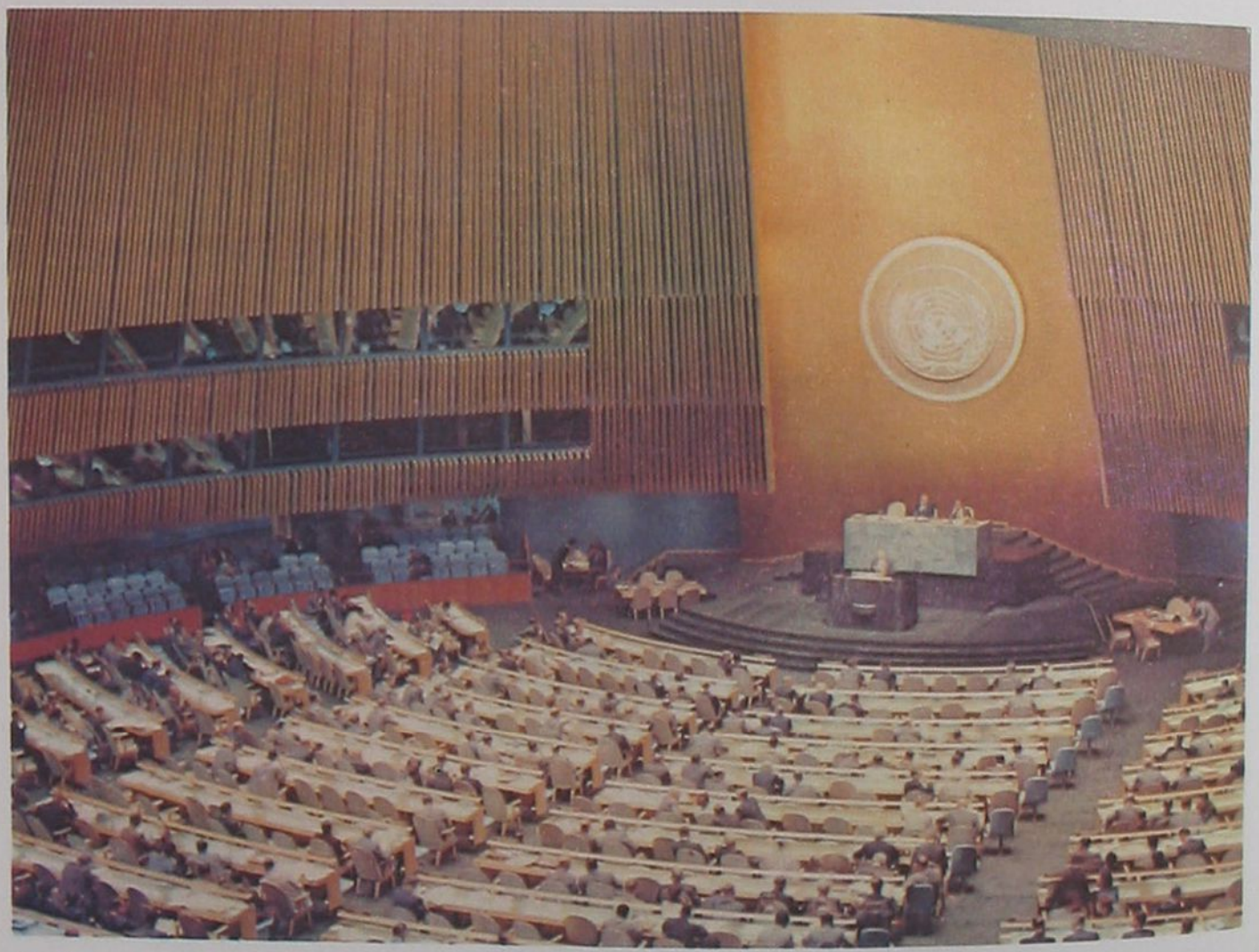
tinued. At a conference at San Francisco, the Charter of the United Nations was signed (26 June, 1945) by fifty states. The U.N. began to function on 24 October, 1945. Its permanent headquarters is in New York in the U.S.A.

The U.N. is an association of independent states, to preserve peace and to prevent war. The permanent staff of the U.N. is headed by the Secretary-General who is in charge of the Secretariat. The first of the main organs is the General Assembly where all members, irrespective of the size or population of the country, have one vote. Most of its work is done in its six main committees.

The second organ is the Security Council which has the main responsibility for dealing with war and threats of war. It has 15 members; five are permanent members (U.S.A., U.S.S.R., U.K., France and Communist China) and ten are non-permanent, elected for two years. To make a decision requires a vote of nine members but this must include the votes of the five permanent members. This is called the 'unanimity rule' or more popularly, the 'veto', because any one of the 'five', by casting its vote against a resolution, can prevent it being accepted, even if all the other members of the Council are in favour.

The other organs are the Social and Economic Council (made up of 27 members elected by the General Assembly) which deals with the work of the Specialized Agencies of the U.N. such as the World Health Organization, the International Monetary Fund, etc., and the Trusteeship Council which supervises the work of the trust territories. Most of these have now gained independence. Other main organs are the Secretariat and the International Court of Justice at The Hague.

The General Assembly of the United Nations in session.



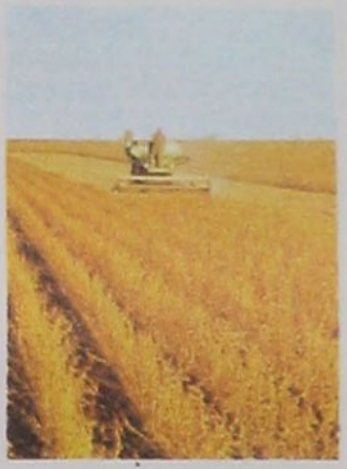
By late 1973, the membership of the U.N. had grown to 134, including both East and West Germany and mainland China, which was admitted in 1971.

United States This is one of the world's largest and richest countries. Its full name is the United States of America. It is often referred to as America.

The country consists of the central part of North America, Alaska in the north-west of the continent and Hawaii in the Pacific Ocean. (See Alaska; Hawaii.)

The main part of the United States is bounded by Canada to the north, the Atlantic Ocean to the east, Mexico and the Gulf of Mexico to the south and the Pacific Ocean to the west.

The United States is a country of great contrasts. It includes the icy wastelands of Alaska, rugged mountain chains, hot deserts and magnificent holiday resorts in such places as Hawaii, in the Pacific Ocean, and Florida.



Fishing and Agriculture in the U.S.A.

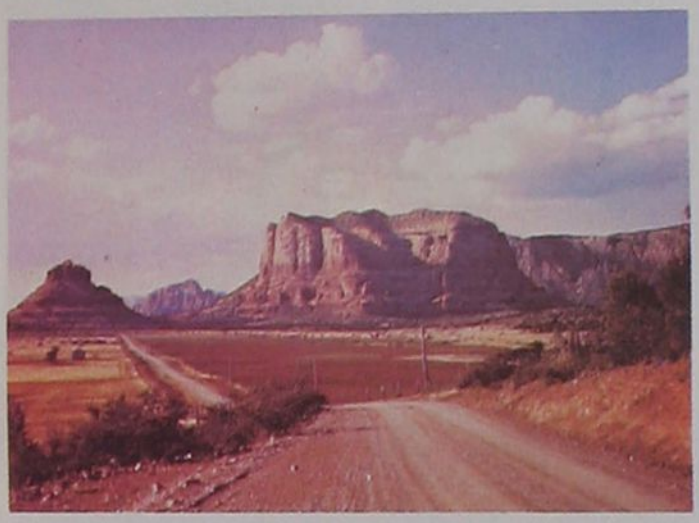
Above: A combine harvester at work, Illinois.

Left: A fisherman repairing nets at West Point, Maine, where lobstering is a thriving industry.

Below: Cotton harvesting in Arkansas.

Below: Nebraska, ranks third in the U.S. as a beef cattle state.

Above: Scott's Bluff National Monument stands beside the Oregon Trail in western Nebraska. It served as a landmark for thousands of pioneers.
Below: Cowboy country in Arizona.



A low coastal range of mountains runs close to the Pacific Coast. Parallel to them and about 200 miles inland run two high ranges—the Cascade Range to the north and the Sierra Nevada to the south. These mountains are steep and thickly wooded. East of them is a series of high plateaux, crossed by deep river gorges and canyons. One important river, the Colorado, runs through the breathtaking Grand Canyon (see Grand Canyon). Part of this plateau area, the Great Basin, is desert, with a few large, shallow lakes of salt water. The Great Salt Lake in the eastern part of the basin is the biggest. Much of the area has little rain.

The plateaux are bounded on the east by the Rocky Mountains, whose peaks rise to more than 14,000 feet above sea-level. Forests cover the mountainside and several areas are set aside as national parks. East of the Rockies lies a belt of high plains, with low rainfall. Ranchers rear cattle and sheep on the grasslands there.

The central part of the United States is a vast, fertile plain, through which the great Mississippi and Missouri rivers flow. In the north lie the five Great Lakes (see Great Lakes). The southern and eastern parts of the plain have heavy

STATES OF THE UNITED STATES

State	Area (sq. mi.)	Population	Capital
Alabama	51,609	3,444,000	Montgomery
Alaska	586,400	302,000	Juneau
Arizona	113,909	1,752,000	Phoenix
Arkansas	53,104	1,886,000	Little Rock
California	158,693	19,953,000	Sacramento
Colorado	104,247	2,207,000	Denver
Connecticut	5,009	3,032,000	Hartford
Delaware	2,057	548,000	Dover
Florida	58,450	6,670,000	Tallahassee
Georgia	58,876	4,492,000	Atlanta
Hawaii	6,424	770,000	Honolulu
Idaho	83,557	713,000	Boise
Illinois	56,400	11,114,000	Springfield
Indiana	36,291	5,194,000	Indianapolis
Iowa	56,290	2,825,000	Des Moines
Kansas	82,264	2,249,000	Topeka
Kentucky	40,395	3,219,000	Frankfort
Louisiana	48,523	3,643,000	Baton Rouge
Maine	33,215	992,000	Augusta
Maryland	9,891	3,922,000	Annapolis
Massachusetts	7,826	5,689,000	Boston
Michigan	58,216	8,875,000	Lansing
Minnesota	84,068	3,805,000	St. Paul
Mississippi	47,716	2,217,000	Jackson
Missouri	69,686	4,677,000	Jefferson City
Montana	147,138	694,000	Helena
Nebraska	77,227	1,484,000	Lincoln
Nevada	110,540	489,000	Carson City
New Hampshire	9,304	738,000	Concord
New Jersey	7,836	7,168,000	Trenton
New Mexico	121,666	1,016,000	Santa Fe
New York	49,576	18,191,000	Albany
North Carolina	52,712	5,082,000	Raleigh
North Dakota	70,665	618,000	Bismarck
Ohio	41,222	10,652,000	Columbus
Oklahoma	69,919	2,600,000	Oklahoma City
Oregon	96,981	2,091,000	Salem
Pennsylvania	45,333	11,794,000	Harrisburg
Rhode Island	1,214	950,000	Providence
South Carolina	31,055	2,591,000	Columbia
South Dakota	77,047	660,000	Pierre
Tennessee	42,244	3,924,000	Nashville
Texas	267,339	11,197,000	Austin
Utah	84,916	1,059,000	Salt Lake City
Vermont	9,609	440,000	Montpelier
Virginia	40,815	4,648,000	Richmond
Washington	68,192	3,409,000	Olympia
West Virginia	24,181	1,744,000	Charleston
Wisconsin	56,154	4,418,000	Madison
Wyoming	97,914	332,000	Cheyenne

rainfall, with mild winters and hot summers. Farmers grow wheat in the north, maize (corn), tobacco and wheat in the centre, and cotton in the south.

The plains are bounded on the east by the Appalachian Mountains. Many farms lie in the valleys of the Appalachians. Parts of the coastal plain are swampy, including much of Florida. Much of the Atlantic coastal plain is cultivated, but the north-east is also a thickly populated area, with many large cities. New York City is the largest city of the United States.

The United States has vast natural resources. In addition to huge areas of fertile soil and thick forests, it has great deposits of coal, iron ore, natural gas and petroleum, besides many other minerals including gold and silver. Hydro-electric plants on its rivers produce much of its electricity.

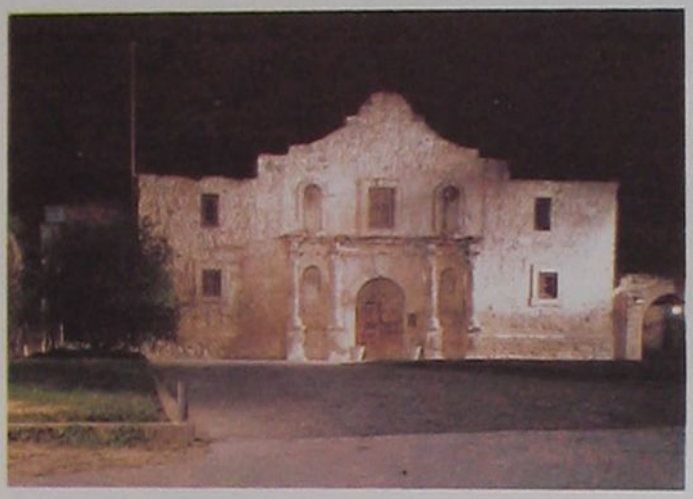
Most of the people of the United

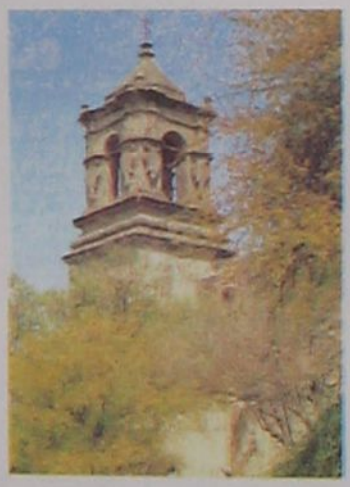
States are descendants of immigrants from Europe. About five per cent are themselves immigrants. About 19,000,000 Negroes, mostly descendants of slaves brought over from Africa between the 1600's and 1800's, live in the United States. There are also about 500,000 American Indians, descendants of the first known inhabitants of North America.

The United States is the world's biggest industrial nation and more than three-quarters of its wealth comes from manufacturing. Its leading products include automobiles, processed food, machinery and chemicals. The mining industries produce huge quantities of coal, natural gas and petroleum. Farmers grow cotton, maize, oats, tobacco and wheat, and rear cattle and poultry. The country exports food and manufactured goods and imports minerals such as cobalt, copper, nickel, tin and uranium.

The United States is a republic with a federal form of government. It consists of 50 states which are *federated*—that is joined together. The capital city, Washington, is situated in a special area called the District of Columbia, which has an area of 69 square miles and a population of 798,000. The head of state is an elected president, who runs the day-to-day government. Congress, also elected, makes the laws. It consists of a senate and a house of representatives. Each state has a similar form of government, headed by an elected governor. The state legislatures make local laws.

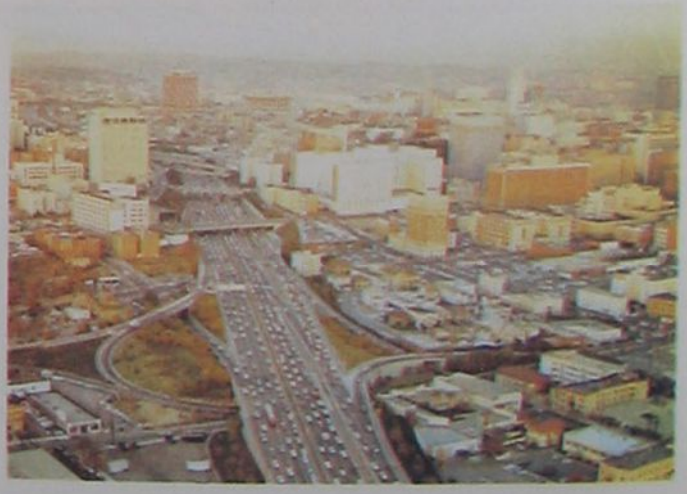
The first Europeans to live in the Americas were Spanish and Portuguese. But the real beginnings of this great country were when the Englishmen left their homes because their religious beliefs were persecuted (see Pilgrim Fathers). Soon thirteen separate colonies came into existence along the Atlantic coast. They had very different origins. The northern colonies were founded by Puritans; Mary-





United States History
Above: The Alamo, in which 180 men withstood 4,000 Mexicans for 13 days during the war for Texan independence, 1836.
Right: Spanish influence. The tower of San Jose Mission, San Antonio, Texas.
Below: A film reconstruction of an early waggon train, escorted by Indian guides.

Below: A typical urban freeway.



PRESIDENTS OF THE UNITED STATES

George Washington	1789-1797
John Adams	1797-1801
Thomas Jefferson	1801-1809
James Madison	1809-1817
James Monroe	1817-1825
John Quincy Adams	1825-1829
Andrew Jackson	1829-1837
Martin Van Buren	1837-1841
William H. Harrison	1841
John Tyler	1841-1845
James K. Polk	1845-1849
Zachary Taylor	1849-1850
Millard Fillmore	1850-1853
Franklin Pierce	1853-1857
James Buchanan	1857-1861
Abraham Lincoln	1861-1865
Andrew Johnson	1865-1869
Ulysses S. Grant	1869-1877
Rutherford B. Hayes	1877-1881
James A. Garfield	1881
Chester A. Arthur	1881-1885
Grover Cleveland	1885-1889
Benjamin Harrison	1889-1893
Grover Cleveland	1893-1897
William McKinley	1897-1901
Theodore Roosevelt	1901-1909
William H. Taft	1909-1913
Woodrow Wilson	1913-1921
Warren G. Harding	1921-1923
Calvin Coolidge	1923-1929
Herbert C. Hoover	1929-1933
Franklin D. Roosevelt	1933-1945
Harry S. Truman	1945-1953
Dwight D. Eisenhower	1953-1961
John F. Kennedy	1961-1963
Lyndon B. Johnson	1963-1969
Richard M. Nixon	1969-

land was a refuge for Roman Catholics; New York began as a Dutch colony; Virginia was settled by squires from southern England; and Georgia was founded to provide a home for English debtors.

Whatever their origins, the settlers were united in wanting to control their own affairs. Between 1775 and 1783, these thirteen colonies rebelled and won their freedom from the English (see Declaration of Independence; Independence, American War of). In 1787 the Constitution of the U.S.A. was drawn up (see Washington, George). It was not easy to unite the ex-colonies. But an example was given to the world by creating a federal state, that is one in which the central government's powers are limited by the independent power of separate states within the federation. This is guaranteed in the Constitution and by the structure of the United States' government.

We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable rights, that among these are life, liberty, and the pursuit of happiness.
The American Declaration of Independence, 4th July 1776

Facts and Figures
Area: 3,675,633 square miles.
Population: 202,179,000.
Capital: Washington D.C.
Money Unit: United States dollar.
Labour force: 70% urban, 30% rural.
Exports: machinery, food, raw materials.
Imports: manufactures, minerals, petroleum.

The young country expanded westwards. The Allegheny Mountains were crossed and the Mississippi, the frontier of the U.S.A., reached in 1783. New states, in the interior, were admitted into the federation, but this put a growing strain on the constitution. The southern 'slave states' were afraid that they would become a minority and slavery be abolished (see Slavery). This conflict was only settled by a civil war which lasted from 1861 to 1865 (see Civil War, American). But before this happened, the U.S.A. had conquered territory in the south and west from Spain and Mexico. Florida and Texas became states in 1845, California in 1850. The U.S.A. was already an advanced democracy with a party system in operation (see Democracy, Political Parties): The two great political parties of the modern U.S.A. go back to early days. The Republican party was formed in the 1850's; the Democratic party is much older.

The victory of the North in the civil

Above: The Harris County Astrodome at Houston, Texas. This is the world's largest enclosed sports arena.
Left: The Statue of Liberty was presented to the United States by France to commemorate the alliance of the two countries during the American War of Independence. In her left hand is a tablet with the date July 4, 1776—the date of the signing of the Declaration of Independence.

war led to the opening of the Middle West by railway lines. The Indians were driven out by ranchers, and many of the ranchers by 'dirt farmers'. Great industrial centres, like Chicago, developed to supply the farmers' needs and to package their produce. By the beginning of the twentieth century the U.S.A. was stretching its limbs like a giant awakening. It began to acquire overseas territories of its own —in the Pacific and West Indies—and to taken an interest in Central and South America.

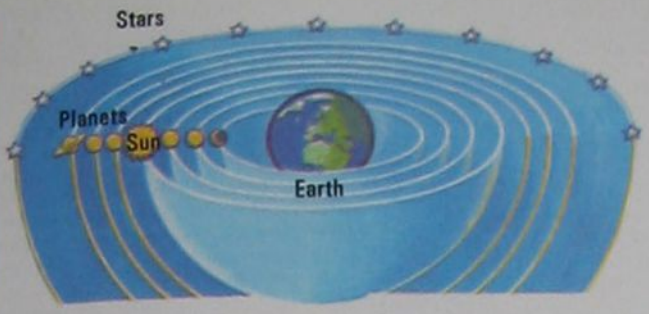
By this time the United States was no longer so 'English'. Throughout the nineteenth century the poor and the oppressed from all over Europe had poured into the new country and helped to build it into the richest, most powerful nation in the world.

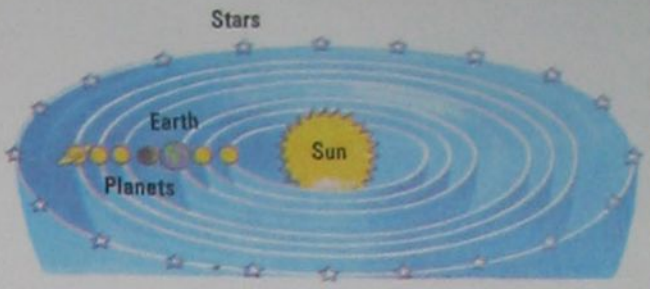
Universe The Universe includes everything that exists, the most distant stars as well as our own Earth and all the objects on it. Nobody knows how big the Universe is, or whether it has any limits. Astronomers have found that all the other galaxies in the Universe are *receding* (travelling away) from our own galaxy. The greater their distance, the greater is the speed at which they are receding. The farthest galaxies observed are travelling at more than half the speed of light. (See Galaxies.)

A simple way to understand the *expanding universe* is to imagine the galaxies as spots painted on a balloon. As the balloon is blown up, its surface stretches and the spots gradually become farther apart. If you sat on one spot you would think that all the other spots were moving away from you, and that you were at the centre of the expansion. You would think this whichever spot you sat upon.

Because the galaxies are racing away from each other at present, many astronomers believe that they must have originally started from a single point in space. This is the *Evolutionary* (changing) *Theory,* sometimes popularly called the 'big bang' theory. According to this theory all the matter in the Universe was originally concentrated in one lump no larger than the size of the solar system but with an enormous density. About 10 thousand million years ago this lump exploded and the Universe started its balloon-like expansion. If this theory is correct, the Universe must have both a definite age and a definite size.

The main rival to the Evolutionary Theory is the *Steady State Theory.* This suggests that the Universe *as a whole* had no definite beginning and will have no definite end. Individual stars and galaxies are continually developing and dying out, and new ones are always being born to replace them. The amount of space between existing galaxies is increasing, but new matter is being created in the spaces so that the total amount remains the same. If this theory is correct the Universe probably has no definite size, but stretches on and on to infinity.



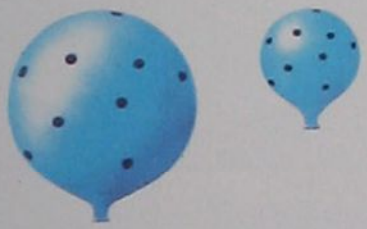


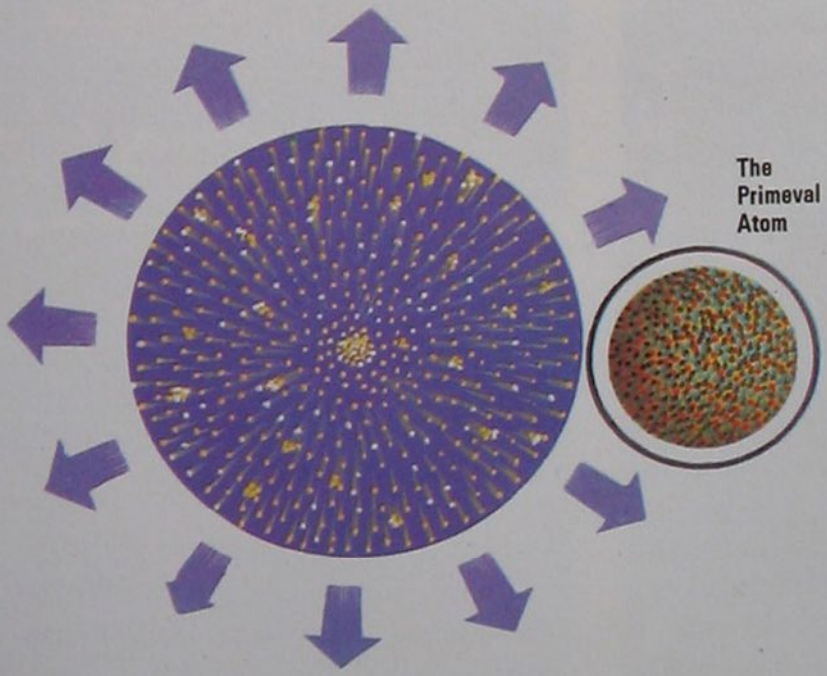
Top left: For a long time men believed that the Earth was the centre of the entire Universe.

Top right: When astronomers realised that planets orbit the Sun, they thought the Sun must be the centre of the Universe. Now we know it is simply one of the millions of stars in the Milky Way galaxy.

Right: According to the 'Big Bang' theory, stars formed from the matter travelling through space after the explosion of the primeval atom.

Below: If this theory is correct, the Universe is still expanding. The galaxies are like spots on a balloon which is being inflated, thus the distance between them is increasing all the time.





It has been suggested that the primeval atom would have been no larger than the present solar system, but of enormous density. When it exploded, matter was flung in all directions through space.

Universities are places in which people, generally in their late teens and early twenties, are educated for skilled work. Doctors and lawyers, business managers and teachers, scientists and engineers usually go to a university after leaving school.

A university is also a place where people are finding out new facts and thinking new ideas. Nuclear power has largely been developed because of the thinking and experiments of university scientists in Britain, Germany and the U.S.A. Nucleic acid (DNA), the blueprint which passes on life from parent to child, was discovered in universities. We understand the world in which we live much better because of the work of university economists and sociologists. These two tasks – teaching at a higher level and research – are the responsibility of universities.

Some universities are over 800 years old. At Bologna in Italy the university was formed by students, in Paris by the teachers. England's first universities were copied from Paris. Oxford began about 1170 and Cambridge about 1209. The oldest American university, Harvard, was founded at Cambridge, Mass. in 1636. By 1970 the U.S.A. had 1,665 universities and higher education institutions with 6,228,000 students. In 1969-70 Britain had 44 universities with 226,000 students. This is twice as many as ten years earlier but includes a much smaller percentage of the population than America's.

A university student passes exams after three or four years and becomes a Bachelor of Arts (B.A.), or of Commerce (B.Com.), or of Science (B.Sc.). He may then study for another year or two and write an original work to obtain a Master's Degree (M.A.). A long work on some original subject, which takes three or four years, is necessary for the Doctor's Degree, Doctor of Philosophy (D.Phil. or Ph.D). The highest Degree of all is given for published works which are outstanding contributions to learning. These are the Doctor of Letters (D.Litt.) or Doctor of Science (D.Sc.). For every degree there is a different gown and hood; these are often brightly coloured.

Talking points

* Many students at universities take *non-vocational* courses which do not train them for any specific job. What is the purpose of taking such a course?
* In recent years, students at some universities have campaigned to have some control over the way in which their universities are run. Discuss to what extent this should happen.
* In recent years, university education has expanded in most countries. Discuss the effect on society of the increased number of highly educated people.

Articles to read

Education; Schools.

Upper Volta is a republic in western Africa. It has an area of 105,869 square miles, and has no coastline. The land is generally dry and rocky. Most of Upper Volta's 5,400,000 inhabitants belong to tribal communities. They are farmers and are among the poorest people in the world. Some livestock, cotton and peanuts are exported. Until 1960, Upper Volta was a French colony. Ouagadougou is the capital.

This map shows the position of Upper Volta.

Ural Mountains are a range of mountains that extend across Russia for about 1,500 miles from the Arctic to the Caspian Sea. They form the traditional boundary between Europe and Asia. Few peaks exceed 5,000 feet, the highest being Narodnaya (6,184 feet). The central section is rich in minerals and has led to the development of great industrial centres in that region.

Uranium is the metal used as 'fuel' in nuclear power stations. Under certain conditions, uranium atoms can be split into smaller pieces. When this happens, enormous amounts of energy are released

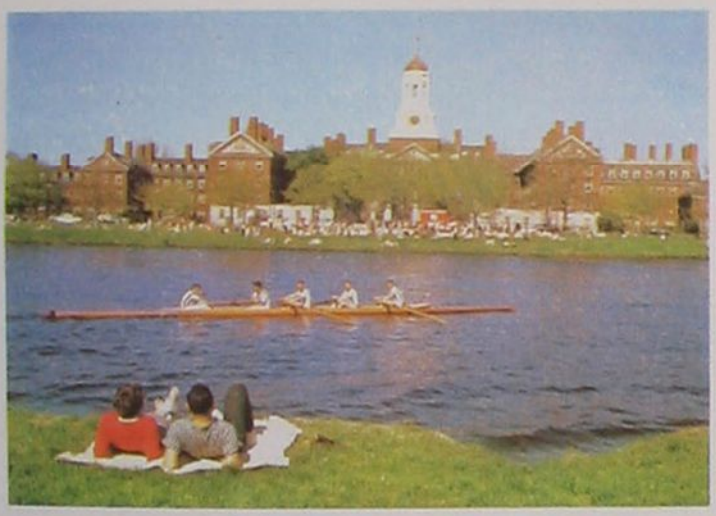
Universities

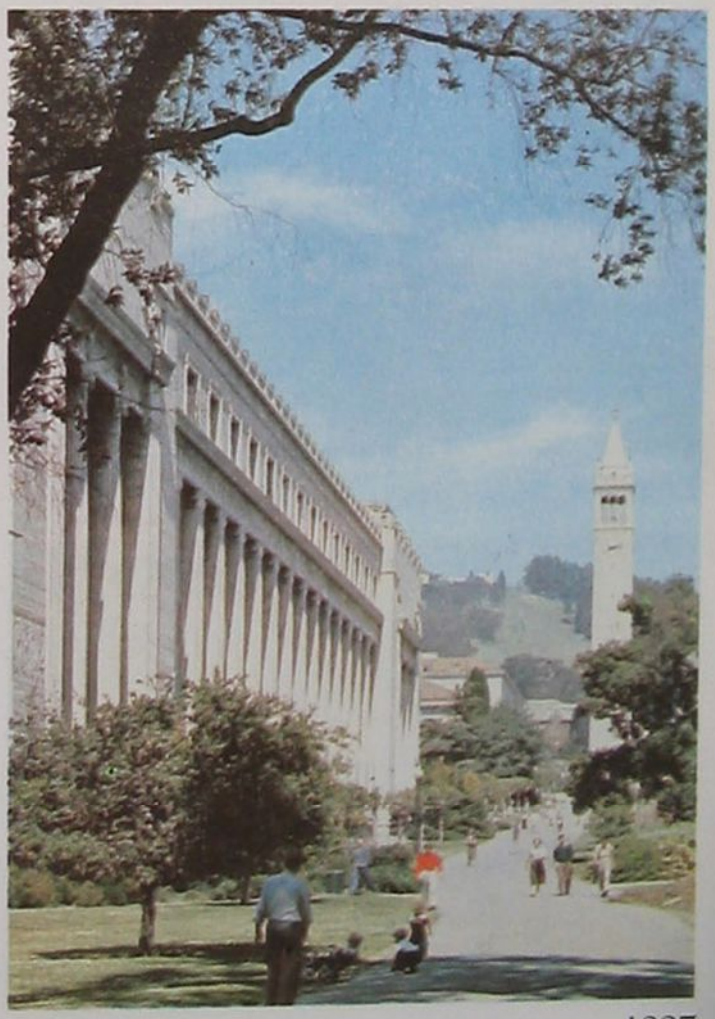
Right: Moscow State University. This building was begun in 1949, and the university opened in September, 1953.

Below: A Harvard rowing crew (coxed fours) in practice on Charles River. Harvard, founded in 1636, is the oldest university in the United States.

Bottom left: Students at St Salvator's College, part of the Scottish University of St. Andrews, wearing the traditional red gowns. St. Andrews was founded in 1411.

Below right: Part of the campus at Yale University.





as heat. (See Nuclear energy.) This process is called *fission*.

Uranium has three natural *isotopes*, or different kinds of atoms, U-238, U-235, and U-234. The numbers signify different atomic weights (see Atom). But U-235 is the only one which undergoes fission. It occurs only in minute traces in natural uranium which is mainly U-238. To be useful as a fuel, U-238 must be enriched with U-235.

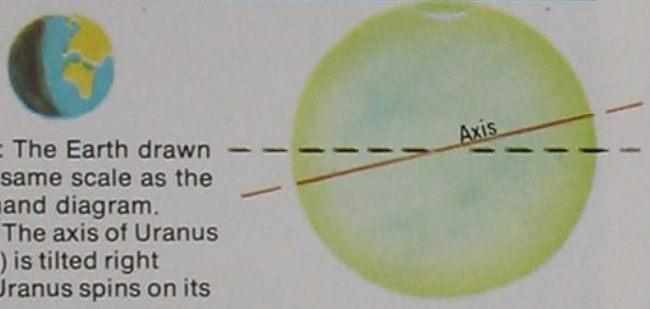
Uranium is a radioactive element which gives off tiny penetrating particles, or *radiation*, from inside its atoms. By so doing it gradually changes into another element. (See Radioactivity.)

The main uranium ore is pitchblende, which contains traces of uranium oxide. Processing is very costly. Prospecting for uranium is done by using a geiger counter which detects radioactive particles coming from the metal.

Uranus In 1781 the English astronomer William Herschel discovered what he took to be a comet moving against the background of stars. Herschel and other astronomers kept watch on the new discovery and plotted its movements. It soon became clear that the 'comet' was, in fact, another planet, beyond Jupiter.

The new planet was called Uranus. It appeared in the telescope as a pale greenish-blue disc.

Uranus is the third largest planet in the Solar System, nearly 30,000 miles across and 1,782 million miles away from the Sun. It takes 84 years to travel once around the Sun, and rotates on its axis in about 10¾ hours.



Above: The Earth drawn to the same scale as the right-hand diagram.
Right: The axis of Uranus (in red) is tilted right over. Uranus spins on its side.
Below: Through a telescope, Uranus appears as a greenish disc.

A location map of Uruguay.

Facts and Figures
Area: 72,172 square miles.
Population: 2,500,000.
Capital: Montevideo.

Uruguay is the smallest of the South American republics, on the south-eastern coast of the continent.

It is bordered by Brazil, Argentina, the Atlantic Ocean, and the estuary of the Rio de la Plata. The land consists mostly of rolling grassy plains. The principal river, the Negro, with its tributary, the Yí, flows westwards into the River Uruguay, which separates Uruguay from Argentina. The climate is pleasant, with warm summers and fairly mild winters.

Most of Uruguay's wealth comes from the herds of cattle and sheep that graze on the vast grasslands. Hides, beef and wool are the main exports. Barley, wheat, maize and linseed are cultivated extensively. The people are of European descent, mainly from Spain and Italy. Spanish is the official language.

In 1828, Uruguay gained its independence from Argentine and Brazilian domination, and from that time on, its history

was largely one of peaceful development. Until the late 1960's it was regarded as a model of democracy. But then financial crises led to the rise of violent left-wing revolutionaries. By the early 1970's military rule was virtually established.

USSR (Union of Soviet Socialist Republics) is the name of the country that was once the Russian empire. More than twice as big as any other country, the USSR occupies more than half of Europe and more than a third of Asia. But its population is only a third of China's.

The East European plain covers most of European Russia. East of this plain, the low Ural Mountains separate Europe from the vast bleak territory of Siberia. South-east of the Urals lies the Turan Lowland of central Asia, which is mainly a desert area. It borders the eastern coast of the Caspian Sea. Mountain ranges extend across central and Eastern Siberia, and across the USSR's southern borders, from Turkey to Mongolia.

Most of the USSR's rivers flow from the north to the south. The Volga, Europe's longest river, flows 2,300 miles into the Caspian Sea. Important canals link it to other waterways and the Baltic Sea. The Don flows into the Sea of Azov, the Ural into the Caspian Sea, and the Dnieper into the Black Sea. The long Lena, Ob and Yenisei rivers flow through Siberia.

Because of its huge size, the USSR is a land of great physical and climatic contrasts. The northern Arctic area is called the *tundra*. Only dwarf trees and shrubs and mosses and lichens grow there. The USSR's great forest land, the *taiga*, lies south of the tundra. About a fifth of all the world's timber grows there.

In contrast, southern Russia is hot enough for palm trees, tea and semi-tropical fruits to grow. The interior of the USSR has an extreme climate. Moscow, the capital, has freezing winters, but some summer days are unpleasantly hot. In most of the USSR, rainfall is light.

The USSR has many kinds of animals.

Above: A view of Novgorod, an historic Russian town not far from Leningrad. The onion-shaped domes on the right are typical of Russian architecture.
Right: A statue of Karl Marx, the effective founder of Communism.
Below: Young horsemen of the Steppes, descendants of the Mongols who once subdued almost the whole of Asia.

Arctic foxes, hares and wolves roam the tundra. Brown bears, deer and lynxes live in the taiga. Reindeer live in both regions. The animals of southern Russia include hyenas, leopards and tigers.

The USSR has a great variety of people. Some resemble eastern Europeans. Others look like Turks, Persians, Mongolians or Chinese. The grandparents of most people in the USSR were Christians belonging to the Russian Orthodox Church. South-

ern Russia is mainly Muslim. But religion has been in decline in Russia since 1917.

About four-tenths of the USSR's workers are farmers. Three-tenths work in manufacturing industries. More than half of all women in the USSR go to work, a far higher proportion than in any other country.

The United States and the USSR are the world's leading manufacturing, scientific and technological countries. The USSR produces almost everything it needs. It grows almost all kinds of grains, fruits and vegetables. Wheat is the main crop. It is grown mainly in the Ukraine. Russia is also rich in minerals. It leads the world in the production of coal, iron ore and manganese, and ranks third in petroleum.

The government owns all factories, farms, mines, shops and offices. Rail transport is more important than road owing to the vast distances that need to be covered.

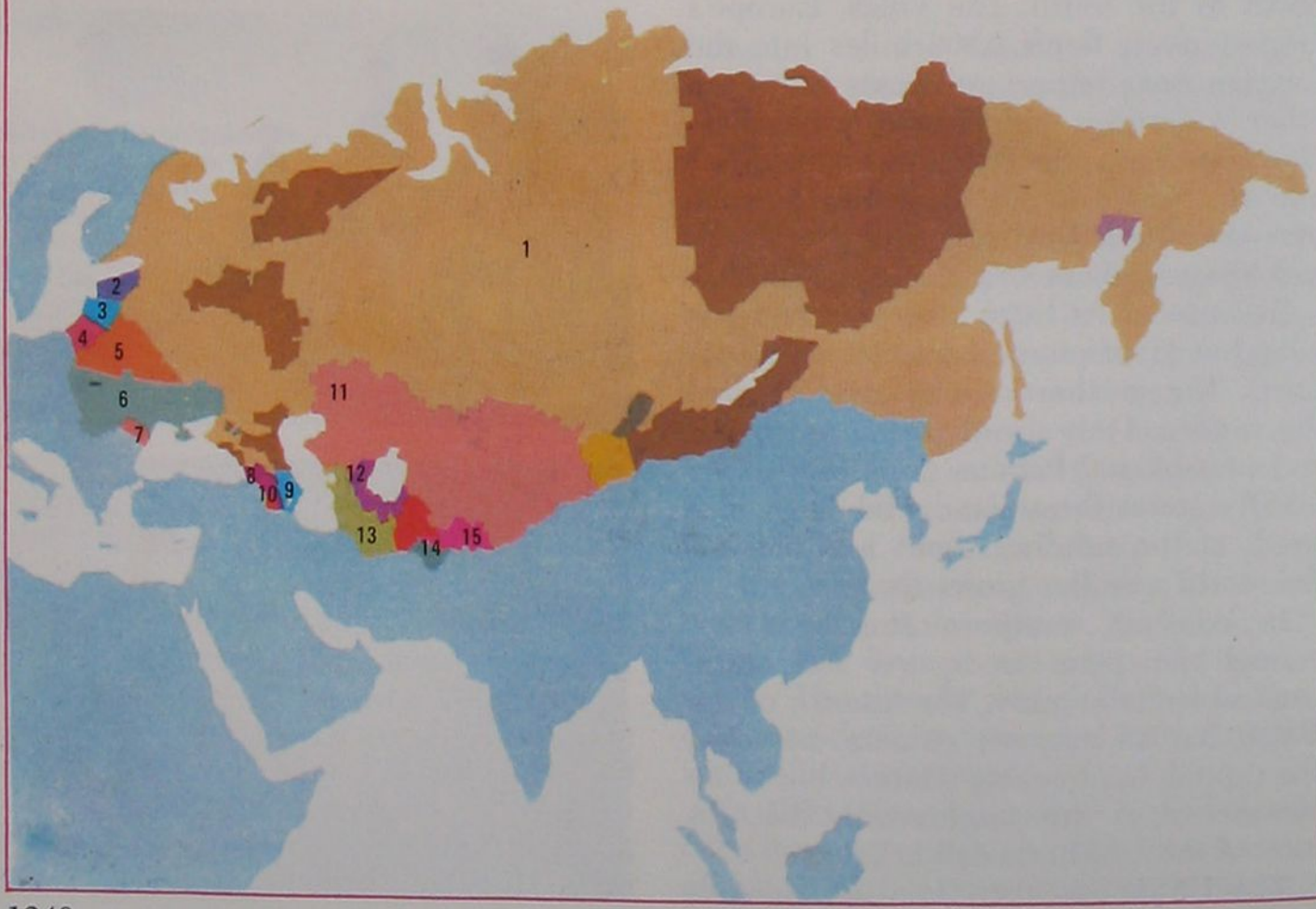
The 15 republics of the USSR are:

SOVIET SOCIALIST REPUBLICS

1. Russian Soviet-Federal Socialist Republic
2. Estonia
3. Latvia
4. Lithuania
5. Byelorussia
6. Ukraine
7. Moldavia
8. Georgia
9. Azerbaijan
10. Armenia
11. Kazakhstan
12. Usbekistan
13. Turkmenistan
14. Tadzhikistan
15. Kirghizia

Facts and Figures
Area: 10,403,000 square miles.
Population: 232,500,000.
Capital: Moscow.
Money Unit: ruble.
Labour Force: 52% rural; 48% urban.
Exports: machinery, petroleum, steel.
Imports: equipment, machinery.

In addition to the 15 Soviet Socialist Republics, there are a number of Autonomous Soviet Socialist Republics, with a measure of control over their own affairs. In addition, within the R.S.F.S.R. itself, there are various Autonomous Regions (dark brown on the map) which comprise minority racial groups. The U.S.S.R. also influences the politics of certain 'buffer states' which are strictly speaking outside its boundaries.



A fruit and vegetable market in the Russian town of Tbilisi.

Armenia, Azerbaijan, Byelorussia, Estonia, Georgia, Kazakhstan, Kirghizia, Latvia, Lithuania, Moldavia, the Russian Soviet-Federal Socialist Republic, Tadzhikistan, Turkmenistan, Ukraine and Uzbekistan. All local governments in the USSR are under the final control of the central government in Moscow, and the Supreme Soviet (the USSR's parliament). Although elected, all people in government jobs must belong to the Communist Party. It controls all aspects of life in the USSR.

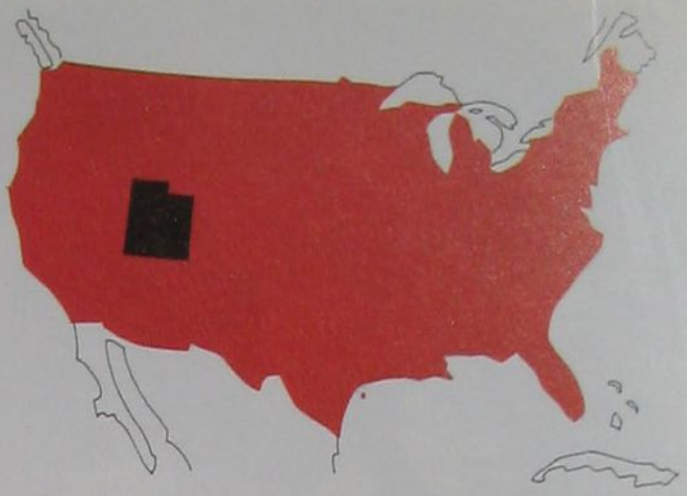
Scythians, Bulgars, Huns, Khazars, Slavs and other peoples moved through western Russia in the period before A.D. 800. By 800, the Slavs had built Novgorod, which means *new city,* in northwestern Russia. In 862, Rurik, a Viking chief, was invited to rule Novgorod. Descendants of his family expanded Novgorod and began the Russian empire. In the 1200's Mongol armies conquered Russia. Tsar (king) Ivan III, whose capital was Moscow, south of Novgorod, drove them out in about 1480. During the 1500's, Russia expanded westwards, and northwards to the Arctic, and conquered Mongol states in the south. It began the conquest of Siberia.

In 1613, Michael Romanov became tsar and his family ruled Russia for 300 years. Tsar Peter the Great (reigned 1682-1725) modernized Russia. From this time, Russia became increasingly involved in European affairs. In 1812, the Russians defeated Napoleon and in 1815, pushed its borders westward into Europe. In 1914-17, Russia fought and lost against Germany in World War I and the Russian empire collapsed. In 1917, Vladimir Lenin made Russia the world's first communist country. He made peace with Germany, but had to surrender much territory in Europe.

In 1922, Russia became the USSR. Gradually, the communists took control of all Russia, including almost all its

property. In 1928, under the leadership of Joseph Stalin, it began a series of five-year plans to modernize the USSR. Germany attacked Russia in 1941, killed millions of its peoples, and destroyed much of its wealth.

After 1945, the USSR began a great drive to try to surpass the economic production of the United States. It also entered into a 'Cold War' with the United States. China, USSR's ally in the 1950's, became almost an enemy in the 1960's. During the 1950's and 1960's, Russia was the United States's rival in space exploration. From 1945, the USSR wielded influence over eastern Europe. In 1968, Russian troops occupied Czechoslovakia to ensure that it remained communist.



This map shows the location of Utah.

Utah is a Rocky Mountain state of the United States, named after the Ute Indians, one of the early tribes that lived there. Salt Lake City, the state capital and largest city, was founded by the Mormons. Utah covers an area of 84,916 square miles and has a population of 1,059,000. The western part of the state is largely desert with many salt beds. The Great Salt Lake is several times saltier than the ocean.

Livestock is the chief agricultural product. Mining and metal-processing are the main industries. Among the many minerals are copper, gold, silver, uranium and oil.

Utah was explored by Spaniards in 1776. Mormons, who were the first settlers, arrived there in 1847, and a few years later asked to join the Union. Statehood was granted in 1896, after the Mormons had agreed to give up *polygamy* (the practice of having more than one wife).

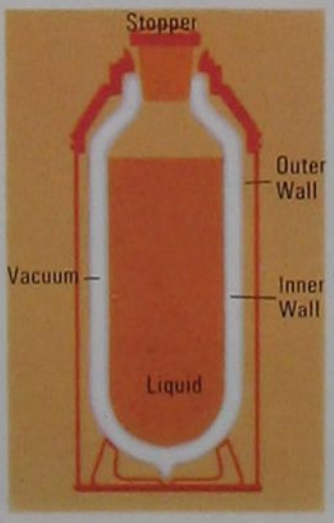
Dead Horse Point, overlooking the Canyonlands National Park in Utah.

V

Vacuum is space that contains no substance of any kind, not even air. There is no *complete* vacuum anywhere in the universe. Outer space is nearly a complete vacuum. But even it contains scattered molecules of hydrogen. Other nearly complete vacuums can be created by pumping the air out of closed containers. Such vacuums are used in vacuum flasks, electronic valves and suction equipment.

Vacuum flask This is a device used to keep cold liquids cold or hot ones hot. It consists of a glass vessel sealed inside another one. The air between the two is removed to form a *vacuum*. A cork closes the mouth of the flask and an outer metal case protects the glass from damage.

Glass, cork and a vacuum are all bad *conductors* of heat—that is, heat passes through them very slowly. The glass surfaces are silvered to make them into mirrors because polished surfaces are bad *radiators* of heat. So if you put hot tea in a vacuum flask it stays hot for several hours. For the same reasons, ice stays solid for many hours.



The vacuum in a vacuum flask is maintained in the space between the double glass walls, and radiation is reduced by silvering the glass.

Sir James Dewar, a British scientist, invented the vacuum flask in the 1880's. It is sometimes called a Dewar flask after him, or a *Thermos* flask, the trade name under which he first sold the flasks.

Van Diemen, Anthony (1593-1645), was a Dutch statesman who did much to strengthen and extend his country's influence in the East Indies.

Van Diemen ran away from the Netherlands to live in the Dutch East Indies because he could not pay his debts. He was such a good administrator that by 1632 he had become general manager of the Dutch East India Company. Four years later he was appointed governor-general of the Dutch East Indies, and during his period of office the Dutch took over most of present-day Indonesia.

In 1642, on an expedition to Australia organized by Van Diemen, the commander, Abel Tasman, discovered a large island off the coast of Australia. He named it Van Diemen's Land (now Tasmania), after the governor-general.

Vancouver, with a population of 1,073,000, is the largest city in the province of British Columbia, Canada. It is also the financial, commercial and industrial metropolis, and the site of the provincial university. The city, incorporated in 1886, stands on the Burrard Inlet on the Pacific coast and is a terminus of the trans-continental railways.

Vancouver is Canada's chief seaport on the Pacific coast with many docks, and possesses the finest natural harbour in the world. Already with a large trade with the Orient, the opening of the Panama Canal greatly expanded its shipping interests.

Vatican This is the residence of the pope in Rome and the centre of the Roman Catholic Church. Originally, the popes lived in the Lateran palace, and only moved to the Vatican at a later date. The Vatican is also the seat of the Sacred

College of Cardinals. Vatican City is an independent state ruled by the pope. It lies on the west bank of the River Tiber and comprises St Peter's Basilica and square, administrative offices, and the Vatican palaces. The pope lives in part of the palaces. The remainder are museums and galleries housing some of the most important collections of paintings and sculptures in the world. The rooms themselves are remarkably splendid, particularly the Borgia apartments and the Raphael rooms. But the best-known monument in the Vatican is probably the Sistine Chapel, with its magnificent paintings by Michelangelo and others.

The independence of the Vatican is guaranteed by the Lateran Treaty ratified in 1929 by Pope Pius XI and Victor Emmanuel III of Italy. The state has a population of about a thousand and an area of about 109 acres. It issues its own postage stamps. An extremely powerful radio station broadcasts to all parts of the world.

Vegetables are plants or parts of plants that we eat. They may be eaten raw in salads or cooked, and are usually part of the main course of a meal. Generally speaking, cereals, nuts and dessert fruits are not counted as vegetables, but there is no hard-and-fast distinction between these kinds of foods. Europeans eat about 80 different kinds of vegetables, and many more are known in Asia.

Vegetables come from every possible part of the plant. Among the parts we commonly eat are the *leaf vegetables*, which include spinach, lettuce, cabbage and parsley; *root vegetables*, such as carrots, beetroots, and parsnips; and *stem vegetables*, such as asparagus. Potatoes are actually *tubers* (underground storage stems). Onions and garlic are bulbs. Cauliflowers, artichokes and broccoli are unopened flowers. Many kinds of peas and beans are seeds and seed pods. Many common vegetables (like cucumbers and tomatoes) are *fruits* (ripened ovaries).

Vegetables provide a number of important nourishing substances in our diet. Yellow and leafy green vegetables are sources of vitamin A. Tomatoes, cabbages and green peppers, among others, are sources of vitamin C. Minerals, including calcium and iron, are also provided by many vegetables. Starchy vegetables (especially potatoes) supply carbohydrates.

An elaborate display of vegetables put up by a firm of seed merchants for a flower show. They include carrots and onions, peas and turnips. Vegetables play an essential part in our diet.